

# **SERVICE QUALITY DIMENSIONS AND CUSTOMER SATISFACTION OF THE SOLAR HOME SYSTEM SERVICE IN BANGLADESH**

A Thesis Submitted in Fulfillment of the Requirements for the Degree of  
**Doctor of Philosophy in Marketing**  
Faculty of Business studies  
University of Dhaka

BY

**SHAMSUN NAHAR MOMOTAZ**

Registration no: 130      Academic Year: 2011-12

Under the supervision of  
**PROF. RAZIA BEGUM Ph.D**  
Department of Marketing  
Faculty of Business studies  
University of Dhaka

June, 2016

**DEDICATION**

**DEDICATED TO**

**MY PARENTS, HUSBAND AND DAUGHTERS**

## **DECLARATION**

I, Shamsun Nahar Momotaz hereby declare that the Ph.D thesis “Service Quality Dimensions and Customer Satisfaction of the Solar Home System Service in Bangladesh” is a presentation of my original work. The work contained in this thesis has not been previously submitted for a degree or diplomat any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made. The work was done under the guidance of Dr. Razia Begum, Professor, Department of Marketing, Faculty of Business Studies, University Of Dhaka, Dhaka, Bangladesh.

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**SHAMSUN NAHAR MOMOTAZ**  
Ph.D student  
Registration no: 130,  
Session: 2011-12  
Department of Marketing,  
Faculty of business Studies,  
University of Dhaka

---

**PROF. RAZIA BEGUM Ph.D**  
Department of Marketing,  
Faculty of Business Studies,  
University Of Dhaka,  
Dhaka, Bangladesh

## **ACKNOWLEDGEMENTS**

It is my pleasure to acknowledge all the people who have helped me in the preparation of this thesis. I am indebted to a number of persons for their kind advice, suggestions, directions and co-operation. I have been able to complete this research with the support and active cooperation of concerned bodies and authorities. First and foremost, I would like to thank my Supervisor, Professor Dr. Razia Begum Ph.D, Department of Marketing, Faculty of Business Studies, University of Dhaka for her valuable guidance and advice at different stages of this research study. It would be quite impossible to carry on this thesis work and make it into the final shape of a thesis without her guidance and sympathetic encouragement. I am truly blessed for her valuable suggestions and support.

My gratitude is also to a number of officers of Non- Government Organizations for their support to prepare this research report. I would like to express my sincere gratitude to all of them, it was quite impossible for me to complete this report without their help. The people whom I would like to show my sincere gratitude especially for giving me their valuable time and assistance for conducting the research accurately are namely: Mohammad Mahmudul Hasan, Manager, Grameen Shakti (GS); Tarun Kanti Karmaker, Unit Manager, Dholla, GS; Md. Borhan Uddin, Unit Manager, Singair, GS; Mr. Gobinda, Unit Manager, Ghior, GS, Md. Rafiqul, Unit Manager, Rafiqnagar, GS, Md. Shahin Mia, Unit Manager, Singair, Rahim Afroz Renewable Energy Limited and Md. Akhtaruzzaman, Senior Officer, Rahim Afroz Renewable Energy Limited. I was immensely benefited from the in-depth interview and pre-testing the cases as well as their guidance throughout the data collection stage of this study.

I am also grateful to Nasrin Akter, Associate Professor, Department of Marketing, Faculty of Business Studies, University Of Dhaka and Dr. Mohammad Rabiul Basher Rubel, Associate Professor, Department of Business Administration, Stamford University Bangladesh. I am, indeed, grateful for their inspiration and support and valuable comments to improve the quality of my research.

I would like to convey my sincere appreciation to my elder brother A S M Ashraful Huq, Asisstant General Manager, ICT Departmnet, Sheltech Private Limited for his great support to conduct the research. I also take this opportunity to thank one of my

relative Md. Mohsin Mia, Office Assistant, Administration Department, Bangladesh Agricultural Research Institute whose co-operation was vital for me in conducting personal in-home survey in remote areas of Sinagair, Manikganj Sadar and Ghior.

I gratefully acknowledge the support received from Stamford University Bangladesh Authority throughout the whole stages of the research. I would also like to thanks to my colleagues, friends and relatives for their encouragement and company to boost my spirit when it was needed most.

Finally, my heartiest thanks go to my family, my husband Dr. Mohammad Zahurul Huq, Junior Consultant, National Institute of Cardiovascular Diseases and my two daughters Mashiat Ibtida Huq and Tahsin Irtiza Huq whose love, affection and encouragement inspired me always. Especially, I would like to thank to my husband and my father Md. Shamsul Huq, former Additional secretary, Ministry of Establishment, GOB who appreciated all of my efforts and guided me to reach rural areas of Manikganj, Nesarabad and Nazirpur districts for data collection.

I am indebted to my mother Begum Delwara Huq for her continuous support to me and prayer for successful completion of my research. At last, but not the least, I express my gratefulness to the Almighty Allah for enabling me to bear all the stress and completing the research in due time.

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Shamsun Nahar Momotaz

## **ABSTRACT**

This thesis has involved in empirical investigation of the service quality dimensions and customer Satisfaction of SHS service in Bangladesh. Solar Home System (SHS) is considered as an important emerging option to supply electricity with quality light, reliable service and long term sustainability. There is a clear need to conduct a research on assessing the dimensions of its service quality and the customer satisfaction of the Solar Home System service in Bangladesh and to provide guidance to the Solar Home System providers to help making strategies and priorities for the improvement of the service quality and customer satisfaction. To address this research question and to achieve the research objective, a comprehensive review of literature was conducted from the international and local (Bangladesh) literature and a quantitative model was developed. To achieve the research objective, primary data were collected by surveying the end-users through a structured questionnaire. The study has observed that the service depends on eight distinct service quality dimensions as responsiveness, assurance, empathy, reliability, communication, image of PO, after sale service, reliability and technology of the service. The hypothesized model was tested by adopting Mediation Analysis and from the analysis it can be concluded that 32.3% variance in the Customer satisfaction can be explained by the service quality dimensions. Four service quality dimensions like responsiveness, tangibility, technology and image of PO are found positively related with customer satisfaction of SHS service in Bangladesh. A positive relationship between five service quality dimensions like reliability, assurance, tangibility, technology and image of PO and perceived value of SHS service has also been found. From the study a positive relationship between perceived value and customer satisfaction of SHS service has also been found. The perceived value has been found as partial mediating

factor in the relationship between the service quality dimensions on customer satisfaction of SHS service in Bangladesh. The findings of this thesis offer important implications for theory and management implications to improve the overall service quality and customer satisfaction of SHS service in Bangladesh. The result suggested that determining service quality dimensions of SHS service is no doubt important to enhance customer satisfaction of the service. As this study is the first one that analyses the service quality dimensions and customer satisfaction of SHS service in Bangladesh, it will therefore provide useful policy insights to the policy makers as well as researchers for improving customer satisfaction of SHS service in Bangladesh. In general, it will help the government to realize the importance and develop ways of providing quality service to rural people and make them satisfied.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

ADB	Asian Development Bank
B/W	Black & White television
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BPDB	Bangladesh Power Development Board
CFL	Compact Fluorescent Lamp
GDP	Gross Domestic Product
GIZ	German Development Cooperation
GOB	Government of Bangladesh
GPOBA	Global Partnership for Output Based Aid
GS	Grameen Shakti
IDB	Islamic Development Bank
IDA	International Development Agency
IDCOL	Infrastructure Development Company Limited
kWh	kilowatt hour
kWp	kilowatt peak
KfW	Kreditanstalt für Wiederaufbau
km	kilometer
MJ	Mega Joule
MkWh	Million Kilowatt hours
MW	Mega watt
NGOs	Non Governments Organizations
PBS	Palli Bidyut Samity
PO	Partner Organization
PV	Photovoltaic
REB	Rural Electrification Board
RERED	Rural Electrification and Renewable Energy Development
RET	Renewable Energy Technology
SHS	Solar home systems
SPSS	Statistical Package for Social Science
WP	Watt peak
WB	World Bank
USD	United States Dollar



# **CHAPTER ONE**

# **INTRODUCTION**

## **1.1 Overview**

In recent years, the terms “service Quality” and “customer satisfaction” have received great attention in competitive business world. On the other hand, Perceived value is claimed to be a major tool to help the service provider to gain a better competitive position in the market by many researchers. Numerous authors explored that higher perceived quality typically leads to higher perceived value and Perceived value variable is found a mediating variable between perceived quality and satisfaction. However, in the present study efforts have been made to find out the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh as well as the mediating effect of perceived value to quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh. The current chapter aims to set out the theme and the significance of this study drawing the development of dimensions of the service quality and the customer satisfaction of the Solar Home System service in Bangladesh. This chapter is comprised of eight sections. It initially reviews background of the study. The justifications for selecting the topic as the focus of the current research are also conferred in this section. Section four outlines the research problems and research objectives. A conceptual framework of the study has been discussed in following section. The sixth section portrays the scope of the study. The significance of the current research has been explained in following section. The structure of the thesis is discussed in section eight. The final section summarizes the key points.

The goals of this chapter are to:

- Review the concept of “service Quality”, “customer satisfaction” and “perceived value”.
- Discuss the research issue along with the background of the research.
- Portray the research problems specifying causes of the problems, research gaps and research questions.
- Focus on justification of the study.
- Express the research objectives.
- Propose a conceptual framework of the study based on a preliminary review of literature.
- Spotlight on distinct areas covered in the study which are specified as of the study.
- Discuss the areas of contribution of the study.
- Provide an outline of the report.

## **1.2 Introduction**

Service quality and customer satisfaction are key factors in the battle to obtain competitive advantage and customer retention. Service quality in marketing literature is the extent to which customers' perceptions of service meet and/or exceed their expectations. While customer satisfaction is a key factor in formation of customer's desires for future purchase (Mittal & Kamakura, 2001). Furthermore, the satisfied customers will probably talk to others about their good experiences. It has been proven from past researches on service quality and customer satisfaction that Customer satisfaction and service quality are related. Most of the researchers found that service quality is the antecedent of customer satisfaction (Parasuraman et al., 1988; Athanassopoulos and Iliakopoulos, 2003; Lee and Hwan, 2005; Naeem and Saif 2009; Balaji, 2009; Bedi, 2010; Kassim and Abdullah, 2010 and Kumar et al., 2010). Service quality is the result of the comparison that customers make between their expectations about a service and their perception of the way the service has been performed (Lehtinen & Lehtinen, 1982; Lewis & Booms, 1983, Grönroos, 1984; Parasuraman et al., 1985; 1988 and Caruana, 2002). Parasuraman et al. (1991) have referred to fivefold dimension of reliability, responsiveness, assurance, empathy and tangibility as a basis for making a tool for testing the service quality, known as SERVQUAL. Moreover, Grönroos (1984) refers to three dimensions of output technical quality, service performance quality, and organization's mental picture. Also, Lehtinen and Lehtinen (1982) also have referred to physical quality, interactive quality, and organizational quality as three dimensions of service quality. Cronin & Taylor (1992) argued that performance is the measure that best explains customers'

perceptions of service quality, so expectations should not be included in the service quality measurement instrument. They developed a performance-only scale called SERVPERF. Rust and Oliver (1993) offer a three-component model in which the overall perception of service quality is based on a customer's evaluation of three dimensions of the service encounter like the service product (i.e., technical quality), service delivery (i.e., functional quality) and service environment. Dabholkar et al. (1996) proposed two alternative models of service quality for technology-based self-service options like the attribute model (what customers would expect service) and the overall effect model (consumers' feeling towards the use of technology). On the other hand, Perceived value is one of the most important elements for gaining competitive edge and is considered to be a significant predictor of customer satisfaction and loyalty (McDougall and Levesque, 2000; Cronin et al., 2000; Gallarza and Saura 2006). Numerous authors explored that higher perceived quality typically leads to higher perceived value (Cronin et al., 2000; Petrick, 2002, 2004; Turel and Serenko, 2006; Hutchinson et al., 2009; Kuo et al., 2009; Lai et al., 2009; Wu and Liang, 2009). Eggert and Ulaga (2002) found that properly implemented service quality characteristics (i.e., reliability, responsiveness, assurance and empathy) can increase individuals' perceive value about the quality features. As a result, it might lead to an increased customer satisfaction. On the other hand, perceived value is found as a mediating variable between perceived quality and satisfaction (Caruana et al., 2000; Cronin et al., 2000, Varki & Colgate, 2001; Sureshchandar at al., 2002; Yunus et al, 2009; Ismail et al. 2009 and Uddin and Akhter 2012). The brief review presented above indicates that "service Quality", "customer satisfaction" and "perceived value" can be studied from different aspects. However, in the present study efforts will be

made to find out the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh as well as the mediating effect of perceived value to quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh.

### **1.3 Background of the Study**

The international and national literature is abounding with conceptual and empirical works on service quality dimensions, customer satisfaction and perceived value. Quality of service and customer satisfaction is critical factors for success of any business (Grönroos, 1990; Parasuraman et al., 1988). So the relationship among service quality and customer satisfaction has received considerable attention in the marketing literature (Cronin and Taylor, 1992; Zeithaml et al., 1996; Brady et al., 2001; Meuter et al., 2000 and Olorunniwo et al., 2006). Several studies showed that service quality may indirectly and directly affect customer satisfaction. On the other hand, Customer-perceived value has been found to be a major contributor to purchase intention (Chang and Wildt, 1994). Several scholars examined association between service quality and perceived value in their studies (Hutchinson et al., 2009; Kuo et al., 2009; Lai et al., 2009; Wu and Liang, 2009). Moreover, many authors in different theoretical and empirical studies (Patterson and Spreng, 1997; Cronin et al., 2000) conceptualize a model of perceived value as the link among quality, sacrifices and satisfaction. Perceive value acts as a mediating variable in the relationship between service quality characteristics and customer satisfaction (Caruana et al., 2000; Cronin et al., 2000, Varki & Colgate, 2001; Sureshchandar et al., 2002; Yunus et al., 2009; Ismail et al., 2009; Uddin and Akhter, 2012). In order to remain competitive, Solar

Home system Service providers in Bangladesh need to satisfy their customers by offering Quality of service. The focus of this thesis is to find out the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh as well as the mediating effect of perceived value to quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh. By searching the literature a striking imbalance is found where relative little attention has given to identify the determinants of service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh. Solar Home System (SHS) is considered as an important emerging option to supply electricity with quality light, reliable service and long term sustainability. It converts sunlight directly into electricity to power lights, fans, mobile charger, televisions, DVD player and laptops. By using these systems rural people can improve their social condition through education, lighting shopping places, telecommunication through SHS powered mobile phones, etc. Moreover, around 70,000 people are directly or indirectly involved in the industry. Moreover, by replacing kerosene lamps it helps to reduce considerable amount of green house gasses like CFC and eventually keep our environment healthy. So SHS is playing a dominant role to the daily life of rural people and there are opportunities to investigate the dimensions of service quality and the customer satisfaction of the service. Till March 2015, a total of 35,96,979 SHSs have been established by the 47 Partner Organizations (POs) of a Government owned financial institution: Infrastructure Development Company Limited (IDCOL) in the off-grid rural areas. Through this way Solar Home systems have already made significant headway in Bangladesh. But the high cost of installation and parts of the system; scarcity of technical people, lack of customer training, inadequate after sales service,

etc., are seen as the barriers in the promotion of Solar home System service. So, measuring service quality dimensions and the customer satisfaction of the Solar Home System service are important from two perspectives. First, from customer's perspective, having good quality service can make the customer satisfied, dependent and relied on the seller. From the seller perspective, he should try to standardize service quality to provide consistency of quality and make long lasting relationship with the customers for attaining competitive advantage.

But reference to service quality dimensions and customer satisfaction of Solar Home System service in Bangladesh is scarce in literature. One study by Khan and Haque (1998) indicated that users of Solar Home systems have expressed the expectation of high standard of service. Price is found as key variable along with convenience of use, safety and the availability of support services to make the SHS and alternative to the traditional sources of rural energy. A high level of customer satisfaction also must be sustained and widespread adoption of the SHS is to be achieved. Ahammed and Taufiq (2008) discussed the factors contributing to the successful promotion of solar PV based rural electrification are suitable finance schemes, regular and proper maintenance and supplying spare parts, and available configurations to suit the consumers' needs and affordability. Aziz et al., (2009) found that the customers are largely satisfied with the availability and quality of the financing and sales services of the partner organizations where the study has measured the satisfaction level of the consumers in eight areas of the SHS service namely number of appliances supported, stability of electricity, quality of electricity, frequency of breakdowns, helpful information from the company, financing facilities of the company, troubleshooting services. According to Khan and Azad (2014) the main problem of dissatisfaction with SHS is related to low frequency of response; irregular technical service, and



shortage of manpower. The main determinants of user satisfaction are equipment quality, energy saving, and the perceived improvement in lifestyle of households with SHS (komatsu et al, 2013).

In summary, the review reveals that no systematic attempt has been made in the literature to examine the relationship between service quality dimensions and customer satisfaction of the Solar Home System service in Bangladesh as well as the mediating role of perceived value to service quality dimensions and customer satisfaction. So this research aims at assessing the dimensions of its service quality and the customer satisfaction of the Solar Home System service in Bangladesh and the mediating role of perceived value to service quality dimensions and customer satisfaction. The study will provide guidance to the Solar Home System providers to help to make strategies and priorities for the improvement of the service quality and the customer satisfaction.

## **1.4 Research Problems**

### **1.4.1 Cause(s) of the Problem**

The commercial success of the Solar Home System industry in Bangladesh depends on assessing the dimensions of the service quality and the customer satisfaction of the Solar Home System service which will affect the satisfaction of the end users and make long-term relationship with the service provider. But till today this industry cannot play a vital role to fill this gap due to lack of understanding of the dimensions of the service quality and the customer satisfaction of the Solar Home System service in Bangladesh. So there is a clear need to conduct a research on assessing the dimensions of its service quality and the customer satisfaction of the Solar Home

System service in Bangladesh and to provide guidance to the Solar Home System providers to help to make strategies and priorities for the improvement of the service quality and the customer satisfaction. This section discusses the research gaps. The research questions for the current study are also developed in this section.

### **1.4.2 Research Gaps**

In the international literature there are substantial studies to assess the impact of service quality dimensions on customer satisfaction. A significant amount of researchers have made an invaluable contribution to understanding the service quality dimensions like Lehtinen & Lehtinen (1982); Lewis & Booms (1983); Grönroos (1984); Parasuraman et al. (1985, 1988); Cronin and Taylor (1992); Boulding et al. (1993); Ford et al. (1993); Zeithaml et al. (1996) and Caruana (2002). Furthermore, in recent years, a plethora of empirical studies on the relationship between service quality dimensions and customer satisfaction have been conducted by many researchers like Wang and Lo (2002); Yunus et al (2009); Siddiqi (2010); Culiberg & Rojšek (2010); Ogunnaike and Olaleke (2010); Jhandir (2012), Gera et al (2011) and Naeem and Saif (2011). But the studies on solar Home System service in Bangladesh as mentioned in earlier section are few. Many researchers have discussed the characteristics and derived benefits of solar electrification in Bangladesh like Khan and Haque (1998); Barua (2001); Ahammed and Taufiq (2008); Aziz et al. (2009); Khan (2012); Khan and Azad (2014); Hoque and kumar (2015). SHS becomes a financially viable investment by household (Asaduzzaman et al., 2013; Blunck, 2007). The main determinants of user satisfaction are equipment quality, energy saving, and the perceived improvement in lifestyle of households with SHS (komatsu et al, 2011).

Most of these studies did not cover service quality dimensions, customer satisfaction and the mediating role of perceived value to service quality dimensions and customer satisfaction. To the best of the author's knowledge, no previous empirical studies have evaluated the determinants of SHS satisfaction. Therefore, the research tries to quantitatively evaluate the determinants of user satisfaction and provide policy implications for further promoting rural electrification with SHS. The present study is an endeavor to fill the above mentioned gaps and analyze the prevailing service quality and customer satisfaction problems of the rural people of Bangladesh.

### **1.4.3 Research Questions and Objectives**

Given the background of the study and overview of the research problem, there seems to be an imminent need to analyze the variables that determines the service quality of the Solar Home Systems service in Bangladesh and to assess the influence of service quality to customer satisfaction; service quality to perceived value of the service and the mediating effect of perceived value to quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh.

Hence, the central research questions to be addressed in this proposed study is sated below:

- 1 What variables determine the service quality dimensions of the Solar Home Systems service in Bangladesh?
- 2 How does service quality influence customer satisfaction of the Solar Home Systems service in Bangladesh?
- 3 How does service quality influence perceived value of the Solar Home Systems service in Bangladesh?
- 4 How does perceived value influence customer satisfaction of the Solar Home Systems service in Bangladesh?
- 5 How does service perceived value mediate service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh?

To answer the above research problem, the objectives of this study are as follows-

- To identify dimensions of service quality for the SHS service in Bangladesh.
- To assess how service quality dimensions influence customer satisfaction of the Solar Home Systems service in Bangladesh.
- To appraise how service quality dimensions influence perceived value of the Solar Home Systems service in Bangladesh.
- To estimate how perceived value influences customer satisfaction of the Solar Home Systems service in Bangladesh.
- To appraise how perceived value mediates service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh.

These objectives are conceptualized into testable hypotheses in the third chapter of this study. A conceptual research framework has been developed and tested to assess

the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. Answering the four research questions will help in developing pertinent policy recommendations focusing on identifying the ways to improve service quality and the customer satisfaction of the Solar Home System service of Bangladesh.

## **1.5 Conceptual Framework**

The literature had been used as the foundation to develop a conceptual framework for the study which is shown in figure 1.1. This conceptual research framework assesses the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. The theoretical model guiding the investigation is adapted from Agus et al. (2007), Caruana (2002) and Ismail et al. (2009). The model includes four main hypotheses, which has been tested in chapter seven. Hypothesis (H1) reflects the influence of service quality dimensions on customer satisfaction. Hypothesis (H2) reflects the influence of service quality dimensions on perceived value. Hypothesis (H3) reflects the influence of perceived value on customer satisfaction. Hypothesis (H4) reflects the mediating effects of perceived value to service quality dimension and customer satisfaction.

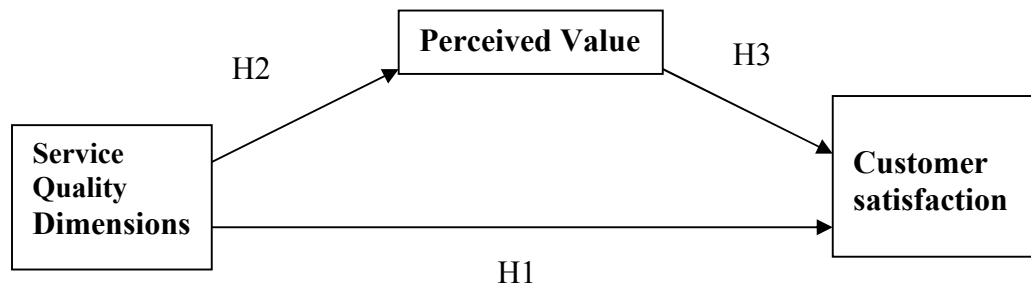


Figure 1.1: Conceptual Model of the Research (adopted from Caruana, 2002; Agus et al., 2007 and Ismail et al. 2009)

Here the service quality dimensions have been treated as the independent variables and the customer satisfaction as the dependent variable. This research studied total seven factors of service quality, out of them five factors are adopted from SERVQUAL model of Parasuraman et al. (1985) namely: reliability, responsiveness, assurance, empathy and tangibility and two factors from the Grönroos model (1984) namely technology and image of Partner organization. Here the service quality dimensions have been treated as the independent variables and the customer satisfaction as the dependent variable. The perceived value acts as the mediating variable between service quality dimensions and customer satisfaction. The hypotheses for the relationships in the model have been proposed in the sections to follow:

H1: There is a positive relationship between service quality dimensions and customer satisfaction of SHS service in Bangladesh.

H2: There is a positive relationship between service quality dimensions and perceived value of SHS service in Bangladesh.

H3: There is a positive relationship between perceived value and customer satisfaction of SHS service in Bangladesh and

H4: Perceive value mediates the service quality dimensions on customer satisfaction of SHS service in Bangladesh.

## **1.6 Scope of the Study**

The proposed investigation combines the optical considerations (discussed in chapter 2) providing better conceptualization of service quality and the customer satisfaction of the Solar Home System service of Bangladesh. Such an approach is proposed to cover:

- This study reviewed studies on relationship between service quality and customer satisfaction; service quality and perceived value and perceived value and customer satisfaction for developing a proposed framework.
- Theoretical arguments such as “SERVQUAL Model”, “Grönroos Model”, Agus et al. (2007), Caruana (2002) and Ismail et al. (2009) have provided the basis as well as solid foundations toward extending beliefs in regard to SHS service.
- The influences from theories and literature have indicated that constructs such as reliability (the ability to perform the promised service dependably and accurately); tangibility (the appearance of the physical facilities, equipment, personnel, and communication materials); responsiveness (the willingness to help customers and provide prompt service); assurance (the knowledge and courtesy of employees and their ability to convey trust and confidence); and empathy (the caring, individualized attention provided to the customer),

technology (what the customer is actually receiving from the service) and image of the PO (image and brand of a PO).

- A thorough review of relationship between service quality and customer satisfaction reveals that, influence of service quality dimension on customer satisfaction is indirectly affected by perceive value.
- This study also reviewed studies on relevant literature related to Solar Home Service and relevant literature related to Solar Home Service in Bangladesh.
- The concept of service quality is consolidated primarily from different broad views into specific perspective i.e. Service quality of the Solar Home System service of Bangladesh.
- The study additionally consolidated and focused on the other pertinent studies where most of the identified variables have been examined from other perspectives like the socio-economic conditions are found from Statistical Pocketbook by BBS, website of IDCOL etc.
- Data have been collected from rural households and retailers for assessing service quality and customer satisfaction of SHS service.
- The proposed model has been tested to assess the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh.



## **1.7 Significance of the Study**

Rural electrification through Solar Photovoltaic Systems is becoming more popular, day by day in Bangladesh particularly in remote, inaccessible areas. The enthusiasm for solar electricity in the rural areas has been encouraging for the obvious advantage it offers. But to produce it commercially the question of customer satisfaction is vital. A research should be undertaken for developing a model for outlining of what needs to be done to improve the service of the Solar Home Systems in Bangladesh. For that purpose the researcher tries to assess the service quality and the customer satisfaction of the Solar Home System service in Bangladesh. The current research is highly significant as it sheds light on the service quality dimensions and customer satisfaction. But to the best of the author's knowledge no previous study has been found to assess the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh. In this perspective, the present study may claim to have some extent of novelty in discussing the service quality dimension and the customer satisfaction of the Solar Home System service in Bangladesh. This study will fill this gap. The findings and understanding of the Bangladesh case can be an important reference for the study of similar problems in other developing countries. From a managerial point of view, the understanding of the service quality and the Customer Satisfaction of the Solar Home System service in Bangladesh can suggest guidelines for making the customers satisfied and retaining in future. Therefore, this study will contribute to customer relationship management and practice in the Solar Home System service in Bangladesh. When such studies confirm, support, and strengthen the findings of this research and offer additional strategic guidance, the service of the Solar home Systems in our country could be significantly improved. As

this study is the first one that analyses the service quality dimensions and customer satisfaction of SHS service in Bangladesh, it will therefore provide useful policy insights to the policy makers as well as researchers for improving customer satisfaction. Overall, it will help the government to realize the importance and develop ways of solving SHS service problems of rural people.

## **1.8 Structure of the Thesis**

The overall outline as well as organizational pattern of this thesis is discussed in this section. The thesis comprises seven chapters and each of the chapter is introduced as follows:

Chapter 1: Introduction: It introduces the topics of rationale, the research background, research problem, conceptual framework, scope of the study, significance of the research and a brief overview of chapters of the thesis.

Chapter 2: Literature review: It provides the concepts of service, service quality dimension and perceived value. It also focuses on relevant theoretical tools for analyzing the influence of service quality dimensions to perceived value; influence of perceived value to customer satisfaction and mediating effects of perceived value to service quality dimension and customer satisfaction. The relevant theoretical literature with the purpose of providing the theoretical foundation for developing the analytical model of this study is described.

Chapter 3: Conceptual framework: It discusses a framework for conceptual insight to explore the influence of service quality dimensions to perceived value and influence of perceived value to customer satisfaction. This chapter further proposes a competing

model to verify the mediating impact of perceived value to service quality dimensions and customer satisfaction of SHS service in Bangladesh with hypothesized relationships.

Chapter 4: Methodology: It covers all the quantitative and qualitative research approaches to be followed in this study. Research designs, data collection strategy, sampling design, measurement of constructs and data preparation of the study are the topics covered here.

Chapter 5: Socio-economic Background of Bangladesh: A brief socio-economic background of Bangladesh is considered in this chapter to show the socio-economic background of SHS user in Bangladesh. It covers country profile, current energy status in Bangladesh and rural electrification and solar energy practice in Bangladesh.

Chapter 6: Solar Home System Industry of Bangladesh: The purpose of this chapter is to review the empirical background of this study for establishing the need to investigate the customer dissatisfaction problems of the rural people. The status of rural electrification in Bangladesh, the relative importance of solar electrification, current practices of SHS industry and Problems faced in the industry are discussed in this chapter.

Chapter 7: Findings of the study: This chapter examines and analyzes the customer satisfaction of SHS service among SHS users. It reports the result of the analyzed data using the techniques justified in chapter four. This chapter delineates the nature and magnitude of the satisfaction problems of the rural SHS users. The review and assessment is based on the analytical framework. This chapter describes sample demographics and usage pattern; examines data entry and missing data; reports and assesses the normality of data; reliability and validity of constructs;; illustrates the

analysis and result of factor analysis to identify the service quality dimensions of SHS service in Bangladesh and explains analysis and result of Hypothesis test.

Chapter 8: Summary and Implications: The findings are summarized in this chapter. Research implications of the findings like the theoretical and practical implications for researchers and practitioners are addressed in the chapter.

Chapter 9: Conclusion and Recommendations for future research directions- This chapter focused on the thesis limitations and overall conclusions. Based on discussion of the research findings recommendations for future research directions are drawn in this chapter.

## **1.9 Conclusion**

This chapter provided the background and overview of this thesis. The current status solar home system service development in Bangladesh is illustrated. Various service quality dimensions and their influences on the customer satisfaction are briefly discussed. The rationale for selecting the solar home system service as the research focus is also outlined in this chapter. The concept of service, quality dimensions and customer satisfaction in the context of rural people and the significance of examining quality dimensions and customer satisfaction problems are also delineated. This chapter also identified the research gaps and developed the research questions. The research objectives, conceptual framework, scope of the study and significance of the research clearly signify the importance of research. The structure of the thesis is also briefly outlined. Given the framework of the thesis the following chapter contains a comprehensive discussion of the relevant theories which emerged from a detailed review of the literature focusing on concepts of service, service quality dimension and perceived value. It also focuses on relevant theoretical tools for analyzing the influence of quality dimension to perceived value and influence of perceived value to customer satisfaction.

# **CHAPTER TWO**

## **LITERATURE REVIEW**

## **2.1 Introduction**

This chapter is designed to explore the theoretical foundation supporting service quality dimensions, perceived value and customer satisfaction studies. The main purpose of this review is to develop a theoretical grounding of this study. For that purpose this chapter is abounded with works pertaining to the theory of the service quality dimensions, perceived value, customer satisfaction, the relationship between service quality and customer satisfaction and the relationship between perceived value and customer satisfaction. In this chapter all these direction have been considered in the context of narrowing the research questions. The objectives of this chapter are to:

- Review of relevant theories and their arguments about service quality dimensions.
- Review of relevant theories and their arguments about service perceived value.
- Consolidate the relevant theories and their arguments about customer satisfaction.
- Review the relevant literature related to relationship between service quality and perceived value and the relationship between perceived value and customer satisfaction.
- Review of relevant literature related to service quality dimensions and customer satisfaction of Solar Home Service in Bangladesh.
- Explore the research gap for the study.

## **2.2 Review of Literature on Service Quality Dimensions**

The main purpose of this review is to identify relevant theories and their arguments about service quality dimensions; perceived value; customer satisfaction; relationship between service quality and customer satisfaction; the relationship between perceived value and customer satisfaction and mediating effects of perceived value to service quality and customer satisfaction. Initially the review consolidates literature on relevant theories regarding service quality dimensions. Then the review identifies some of the key studies that have examined the relationship between service quality and customer satisfaction and service quality and perceived value. Finally this chapter reviews the mediating effects perceived value to service quality and customer satisfaction.

### **2.2.1 Service Quality**

#### **What are Services?**

Services are part of our life from long time and the world economy is characterized as a service economy. The American Marketing association defines services as activities, benefits and satisfactions which are offered for sale or are offered in connection with the sale of goods. Services are different from physical products. One of the fundamental distinctions between goods and services is that “goods” are “things” and a “service” is an “act.” Parasuarman et al. (1985) defined service as multidimensional. These dimensions are intangibility, heterogeneity and inseparability of production and consumption. Compared with manufacturing firms, service marketers face several unique problems in positioning and promoting their offerings. It is more difficult for consumers to evaluate the quality of services than the quality of products. This is true



because of certain distinctive characteristics of services like intangibility, inseparability, variability, perishability etc. (Kotler and Armstrong, 1999).

Davidoff (1994) defined service as "useful labor that does not produce a tangible commodity". According to Kotler & Armstrong (1999), the term service can be defined as "any activity or benefit that one party can offer to another that is essentially intangible and does not result in the ownership of anything". Its production may or may not be tied to a physical product.

Grönroos (2000) stated, "A service is a process consisting of a series of more or less intangible activities that normally, but not necessarily always, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems". Moreover, Lasser et al. (2000) defined service as a set of characteristics that meet the clients' needs, strengthen the links between the organization and them, and enhance the clients' value as well.

Lovelock & Wright (2001) highlight some basic characteristics of services:

- Customers do not obtain ownership- Customers usually derive value from a service without obtaining ownership of any tangible elements.
- There is customer involvement in the production process- Customers are frequently actively involved in creating the service product by helping themselves or by co-operating with the staff rendering the service.
- Time is important- Customers have to be physically present to receive services. Some customers are sensitive to time and often speed is a key element to good service delivery.
- Services are perishable and cannot be stored like physical goods.

According to Zeithmal and Bitner (2003) services are deeds, processes and performances. Lovelock et al. (2004) stated that, services are economic activities that create value and provide benefits for customers at specific times and places as a result of bringing about a desired change in or on behalf of the recipient of the service. Bhattachargee (2006) identified that, services are the production of essentially intangible benefits and experience, either alone or as part of a tangible product through some form of exchange, with the intention of satisfying the needs, wants and desires of the consumers. Three well-documented characteristics of services-intangibility, heterogeneity and inseparability-must be acknowledged for a full understanding of service quality. First, most services are intangible (Berry, 1980). Second, services, especially those with high labor content, are heterogeneous; their performance often varies from producer to producer, from customer to customer and day to day. Third, production and consumption of many services are inseparable (Carman and Langeard, 1980). Quality occurs during service delivery, usually in an interaction between the client and the contact person from the service firm (Lehtinen and Lehtinen, 1982).

To overcome the fact that consumers are unable to compare competing services side-by-side as they do with competing products, consumers rely on surrogate cues (i.e., extrinsic cues) to evaluate service quality (Schiffman and Kanuk, 2004). Because the actual quality of services can vary from day to day, from service employee to service employee, marketers try to standardize their services in order to provide consistency of quality.

In all, service can be defined as an intangible offer by one party to another in exchange of money for pleasure. Services offered by service providers cannot be seen & touched, as they are intangible activities. Services have distinctive characteristics

which differentiate them from goods and have implications for the manner in which they are marketed.

### **What is Service Quality?**

Quality is a key requirement in every field. In terms of Industrial growth quality plays an important role & so should be understood and defined properly. 'Quality' comes from the Latin word 'Qualitas' which refers to the nature of a person or the nature of an object. In the past Quality meant accuracy and perfection. The term service quality is viewed as a multidimensional concept and may be interpreted differently by different scholars. There are many researchers who have defined service quality in different ways. Karim (1996) defined Quality as anything that accords with the characteristics of the product to meet the external clients' needs.

Definitions of service quality revolve around the idea that it is the result of the comparison that customers make between their expectations about a service and their perception of the way the service has been performed (Lehtinen and Lehtinen, 1982; Grönroos, 1984; Parasuraman et al., 1985, 1988, 1991, 1994, Lewis and Mitchell, 1990, Wisniewski, 1996). So, Customer has certain expectation about the service. If the customer experience the same service as they expect then this difference will be zero and we can say that the service quality is very good. Higher the difference of above equation lower will be the service quality.

Quality can also be defined as the totality of features and characteristics of a product or services that bear on its ability to satisfy stated or implied needs (Kotler et al., 2002). It is evident that quality is also related to the value of an offer, which could evoke satisfaction or dissatisfaction on the part of the user. So service quality plays very important role in marketing. Service quality creates competitive advantage for

organizations and is associated with successful organizations (Kandampully, 1998). As service quality impacts on customer satisfaction, this also impacts on customer retention, reduction of costs and increased profitability (Gupta and Zeithaml, 2006).

Service quality has received extensive attention in the literature, with studies being carried out in a wide variety of industries such as the hospitality industry and tourism (Saleh and Ryan, 1992; Fick and Ritchie, 1991), hospitals (Soliman, 1992) and banking (Kwon and Lee, 1994). Lehtinen and Lehtinen (1982) give a three-dimensional view of service quality. They see it as consisting of what they term “interaction”, “physical” and “corporate” quality. At a higher level, and essentially from a customer's perspective, they see quality as being two dimensional, consisting of “process” and “output” quality. This is not too dissimilar from the conceptualization by Grönroos (1984) who emphasizes two main dimensions of service quality in his model as “technical” quality or “what” is received by the customer and “functional” quality or “how” a service is provided. According to Parasuraman, Zeithaml & Berry (1985, 1988) the service quality is defined as the difference between the service expectation & service actually received by the customer. Other researchers (e.g. Cronin and Taylor, 1994) view service quality as a form of attitude representing a long-run overall evaluation. Asubonteng et al. (1996) defined service as the difference between customers’ expectations for service performance prior to the service encounter and their perceptions of the service received. According to Roest and Pieters (1997) service quality is a relativistic and cognitive discrepancy between experience-based norms and performances concerning service benefits. Gefen (2002) explained service as the subjective comparison that customers make between the quality of the service that they want to receive and what they actually get. Salas (2006) defined service quality as “a global judgment or

attitude relating to a particular service; the customer's overall impression of the relative inferiority or superiority of the organization and its services. Service quality is a cognitive judgment".

So, service quality is a concept that has aroused considerable interest and debate in the research literature because of the difficulties in both defining it and measuring it with no overall consensus emerging on either (Wisniewski, 2001). Dagger and Sweeney (2007) argued that due to intense competition in the service sector, service providers are laying more emphasis on service quality to achieve market leadership. According to Strawderman and Koubek (2008), service quality is in the eye of the user and personal preference, expectations and experience all come into play when users judge the quality of a service.

Examination of these writings and literature we have three underlying themes which are as follows:

- Service quality is more difficult for the consumer to evaluate than goods quality.
- Service quality perceptions result from a comparison of consumer expectations with actual service performance.
- Quality evaluations are not made solely on the outcome of a service; they also involve evaluations of the process of service delivery.

In summary, the aim of providing quality services is to satisfy customers. Measuring service quality is a better way to dictate whether the services are good or bad and whether the customers will or are satisfied with it. Customer wants to avail different services offered to them by service providers. Delivered service will become as the quality Service if it meets the customer expectations. But customer expectation depends upon the customer perception, which may differ from person to person.

### **2.2.2 Service Quality Dimensions**

The interest in service quality has been influential in contributing significantly to the growth of the general services marketing field. Early studies during 1980s focused on determining what service quality meant to customers and developing strategies to meet customer expectations (Parasuraman and Berry, 1985). The contemporary discussions on the dimensions of service quality have been initiated by European scholars. The early pioneers of services marketing in Europe, especially the Nordic School, argued that service quality consists of two or three underlying dimensions. Lehtinen and Lehtinen (1982) defined service quality in terms of physical quality, interactive quality and corporate (image) quality. Physical quality includes the physical aspects of the service (e.g., equipment or building); corporate quality involves the company's image or profile and interactive quality derives from the interaction between contact personnel and customers as well as between some customers and other customers.

Grönroos (1984) postulated that three types of service quality exist: Technical quality, which involves what the customer is actually receiving from the service, Functional quality, which involves the manner in which the service is delivered and Image that can be expected to built up mainly by technical and functional quality of service including the other factors (tradition, ideology, word of mouth, pricing and public relations). The model is shown in figure 2.1:

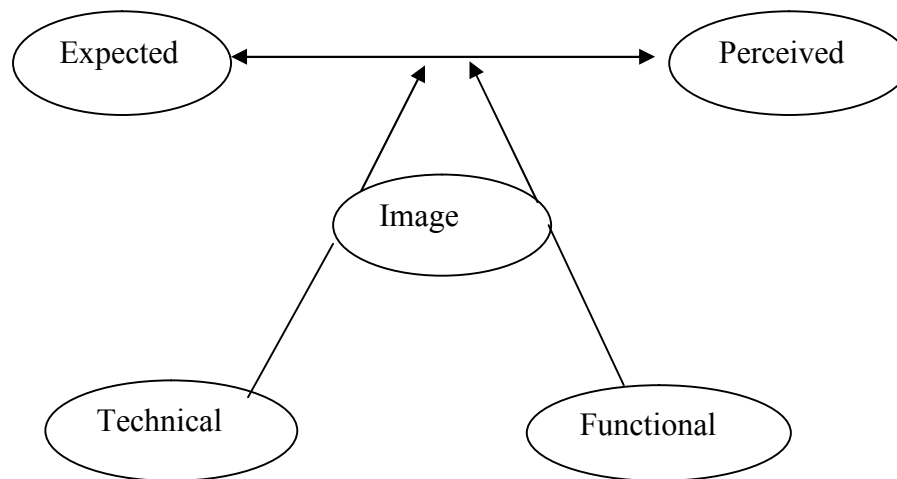


Figure 2.1: The Nordic Model (Grönroos, 1984)

Grönroos later in 1990 conceptualized the service quality perception emphasizing the role of image as a filter in the perception of service quality in addition to the technical and functional quality dimensions. According to him corporate image, or sometimes called local image of an office or organizational unit, is of utmost importance to most service firms. The expectations of the consumers are influenced by their view of the company, i.e., by the image. The corporate image is the result of how the consumers perceive the firm. Therefore, the corporate image can be expected to build up mainly by the technical quality and the functional quality of its service. There are different levels of image (e.g. brand, product or company level) a consumer may associate with a service provider when asked to rate a company's overall image.

Parasuraman et al. (1985) proposed that service quality as a function of the differences between customer expectations and perceptions along the quality dimensions. They developed a service quality model (figure 2.2.) based on gap analysis. The various gaps visualized in the model are as follows in table 2.1:

Table 2.1: Gaps visualized in the Model by Parasuraman et al. (1985)

Gap 1:	Difference between consumers' expectation and management's perceptions of those expectations, i.e. not knowing what consumers expect.
Gap 2:	Difference between management's perceptions of consumers' expectations and service quality specifications, i.e. improper service-quality standards.
Gap 3:	Difference between and service quality specifications service actually delivered, i.e. the service performance gap.
Gap 4:	Difference between service delivery and the communications to consumers about service delivery, i.e. Whether promises match delivery?
Gap 5:	Difference between consumers' expectation and perceived service.

According to this model, the service quality is a function of perception and expectations and can be modeled as:

$$SQ = \sum_{j=1}^k (P_{ij} - E_{ij})$$

SQ = Overall service quality

$P_{ij}$  = performance perception of stimulus I with respect to attribute j

$E_{ij}$  = Service quality expectation for attribute j that is the relevant norm for stimulus i

This exploratory research was refined with their subsequent scale named SERVQUAL for measuring customers' perceptions of service quality (Parasuraman et al. 1988). At this point the original ten dimensions of service quality determinants that were found to have an impact on service quality and were regarded as the criteria that were important to access customer's expectations and perceptions on delivered service which are as follows:



- **Reliability:** the ability of an organization to accurately achieve its services in the proper time and according to the promises it has made to its clients.
- **Responsiveness:** the tendency and willingness of service providers to help clients and satisfy their needs, immediately reply to their inquiries, and solve their problems as quickly as possible.
- **Competence:** having adequate skills and knowledge that enable the employees to perform their jobs properly.
- **Accessibility:** providing easy access to a service in terms of location and through services provided via the telephone, the internet, or any other means of communication.
- **Courtesy:** treating clients respectfully in a polite friendly manner, understanding their feelings, and answering their phone calls gently.
- **Communication:** this occurs through gentlemanly listening to the client conveying information to them clearly and facilitating external communication with workers.
- **Credibility:** this can be achieved through full trust and confidence in the service provider as well as his honesty and straight forwardness.
- **Security:** this depends on whether the service is free from risks and hazards, defects or doubts so that it provides bodily safety, financial security as well as privacy.
- **Understanding/ knowing the customer:** this can be made achievable through the ability to pinpoint the customers' needs as well as understanding their individual problems.
- **Tangibility:** this includes physical aspects connected with service such as instruments and equipment, persons, physical facilities like buildings and nice decoration and other observable service facilities.

They stated that perceived service quality is the result of the consumer's comparison of expected service with perceived service. Determinants of Perceived service quality are stated in the following figure 2.2:

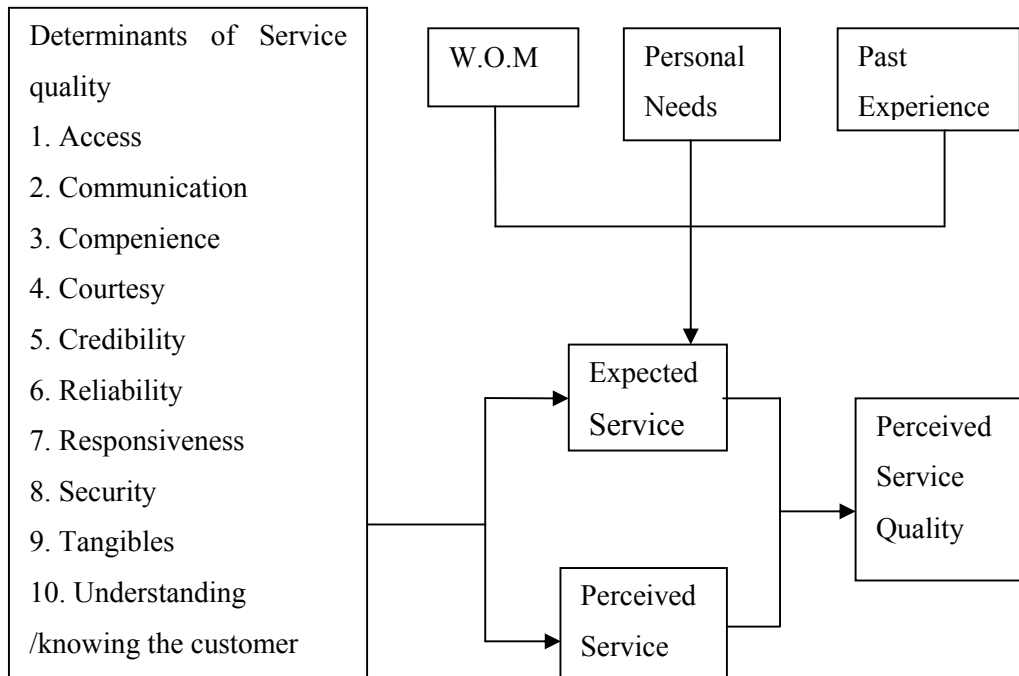


Figure 2.2: Determinants of Perceived service quality (Parasuaraman et al. 1985)

Later, by further investigation of two stages of scale purification SERVQUAL was revised in 1991 by replacing “should” word by “would” and in 1994 by reducing the total number items to 22 for assessing customer perception and expectations regarding the quality of service. A level of agreement and disagreement with a given item is rated on seven-point likert type scale, the level of service quality is represented by the gap between perceived and expected service. In addition to this empirical research, the authors characterized and further delineated the four gaps identified in their research of 1985.

### ***Tangibility***

The tangible Service Quality Dimension refers to the appearance of the physical surroundings and facilities, equipment, personnel and the way of communication. For the restaurant's interiors, the appearance and condition of the cutlery, tableware, and uniform of the staff, the appearance and design of the menu, restaurant signage and advertisements (Parasuarman et al., 1988). Tangibles are used by firms to convey image and signal quality. In other words, the tangible dimension is about creating first hand impressions.

### ***Reliability***

The reliability Service Quality refers to how the company are performing and completing their promised service, quality and accuracy within the given set requirements between the company and the customer. Reliability is defined as “the ability to perform the promised service dependably and accurately” or “delivering on its promises” (Parasuarman et al., 1988). This dimension is critical as all customers want to deal with firms that keep their promises and this is generally implicitly communicated to the firm's customers.

### ***Responsiveness***

The responsiveness Service Quality refers to the willingness of the company to help its customers in providing them with a good, quality and fast service. It is defined as “the willingness to help customers and provide prompt service” (Parasuarman et al., 1988). This dimension is concerned with dealing with the customer's requests, questions and complaints promptly and attentively. A firm is known to be responsive when it communicates to its customers how long it would take to get answers or have their problems dealt with.

### *Assurance*

Assurance is defined as “the employees’ knowledge and courtesy and the service provider’s ability to inspire trust and confidence” (Parasuarman et al., 1988).

### *Empathy*

The empathy Service Quality refers to how the company cares and gives individualized attention to their customers, to make the customers feeling extra valued and special. It is defined as the “caring, individualized attention the firm provides its customer (Parasuarman et al., 1988). The customer is treated as if he is unique and special. There are several ways that empathy can be provided: knowing the customer’s name, his preferences and his needs. Many small companies use this ability to provide customized services as a competitive advantage over the larger firms (Parasuarman et al., 1988).

To confirm the validity of SERVQUAL model in the evaluation of service quality, (Parasuarman et al., 1988), stated that “service quality is a focused evaluation that reflects the customer’s perception of reliability, assurance, responsiveness, empathy, and tangibles”. In summery the model can be summarized as follows in table 2.2:

**Table 2.2: Summary Table of SERVQUAL Dimensions:**

<b>Dimensions</b>	<b>Refers to</b>	<b>Specific criteria that customers use</b>
RELIABILITY Delivering on promises	The ability to perform the promised service dependably and accurately	<ul style="list-style-type: none"> <li>• Timeliness</li> <li>• Consistency/Regularity</li> <li>• Accuracy</li> </ul>
ASSURANCE Inspiring trust and Confidence	The knowledge and courtesy of staff; their ability to inspire trust and confidence	<ul style="list-style-type: none"> <li>• Staff competence</li> <li>• Respect for stakeholders</li> <li>• Credibility</li> <li>• Probity and confidentiality</li> <li>• Safety and security</li> </ul>
TANGIBLES Representing the service physically	The physical representations or images of your service	<ul style="list-style-type: none"> <li>• Physical facilities</li> <li>• Equipment</li> <li>• Technology</li> <li>• Employees</li> <li>• Communication materials</li> </ul>
EMPATHY Treating customers as individuals	The caring individualized attention to customer	<ul style="list-style-type: none"> <li>• Access (to staff, services, information)</li> <li>• Communication (clear, appropriate, timely)</li> <li>• Understanding the stakeholder</li> <li>• Services appropriate for stakeholders' needs</li> <li>• Individualized attention</li> </ul>
RESPONSIVENESS Being willing to help	Willingness to help customers and to provide prompt service	<ul style="list-style-type: none"> <li>• Willingness to help</li> <li>• Prompt attention to requests, questions</li> <li>• Problem resolution</li> <li>• Complaint handling</li> <li>• Flexibility</li> </ul>

The SERVQUAL scale which is also known as the gap model by Parasuraman, et al. (1988) has been proven to be one of the best ways to measure the quality of services provided to customers. This service evaluation method has been proven consistent and reliable by some authors. The SERVQUAL instrument has been productively used for measuring service quality in many proprietary studies. It also served as the basis for measurement approaches used in published studies examining service quality in a variety of contexts-e.g., real estate brokers (Johnson et al., 2009); banks (Caruana, 2002; Sureshchandar et al., 2002; Paswan et al., 2004; Seth et al., 2005;

Lymperopoulos et al., 2006); higher education (Joseph and Joseph 1997), accounting and audit firms (Ismail 2006); health spas (Snoj and Mumel 2002); hotels (Markovic, 2004, 2006,2013; Wang and Zhao, 2007); insurance (Tsoukatos et al., 2004, 2006 and 2007); public-transport (Sánchez Pérez, 2007); restaurants (Andaleeb and Conway, 2006; Namkung and Jang, 2008); travel agencies (Caro and Garcia, 2008) and web-sites (Parasuraman et al., 2005; Nusair and Kandampully, 2008). Thus, up to date, SERVQUAL has proven to be a parsimonious model that has been used in various service organizations and industries to measure service quality.

Jain et al. (2004) held that, when perceived or experienced service is less than the expected service; it implies less than satisfactory service quality; and when perceived service is more than expected service, the obvious inference is that service quality is more than satisfactory. It seems the idea of SERVQUAL best fits the evaluation of service quality from the customer perspective. This is because when it is stated “perceived” and “expected” service, it is very clear that this goes to the person, who is going to or is consuming the service; who definitely is the consumer/customer.

The various replications undertaken have highlighted a number of areas of both theoretical and psychometric concern. This criticism has focused on a number of aspects. First, the conceptualization and usefulness of the expectations side of the instrument have been questioned (Boulding et al., 1993; Cronin and Taylor, 1992; 1994). Second, the problems which expectation scores pose in terms of variance restriction have been highlighted. Third, research has indicated problems associated with difference scores including findings showing that the performance items on their own explain more variance in service quality than difference scores (Cronin and Taylor, 1992, 1994). Finally, the number of factors extracted has tended to vary from the five dimensions proposed (Bouman and Vander, 1992; Cronin and Taylor, 1992,

1994). Peter et al. (1993) argue that because the SERVQUAL scales “scores” are really difference scores (perceptions minus expectations scores); problems of reliability, discriminant validity and variance restrictions exist. (Parasuraman et al., 1991) published their own one-column scale format which cuts the questionnaire size in half and reduces the time required for completion”.

As a result of these criticisms, alternative measures of service quality for specific service settings were developed. In the tourism and hospitality industry, Knutson et al. (1991) developed LODGSERV, a model utilized to measure service quality in the lodging industry which is based on five original SERVQUAL dimensions and contains 26 items. Drawbacks in using SERVQUAL in measuring service quality have been the reason that the SERVPERF scale was proposed by Cronin & Taylor (1992). They argued that performance is the measure that best explains customers’ perceptions of service quality, so expectations should not be included in the service quality measurement instrument. They developed a performance-only scale called SERVPERF. Service quality is evaluated perceptions only without expectations and without importance weights according to the formula:

$$SQ = \sum_{j=1}^k P_{ij}$$

SQ = Overall service quality

$P_{ij}$  = performance perception of stimulus I with respect to attribute j

K = the number of attributes

Along with other researchers in 1994, Parasuraman et al. also mentioned that measurement method using SERVPERF is better than using SERVQUAL, though SERVQUAL can provide better diagnostic results of service quality.

Rust and Oliver (1993) offer a three-component model in which the overall perception of service quality is based on a customer's evaluation of three dimensions of the service encounter: the service product (i.e., technical quality), the service delivery (i.e., functional quality) and the service environment as shown in figure 2.3:

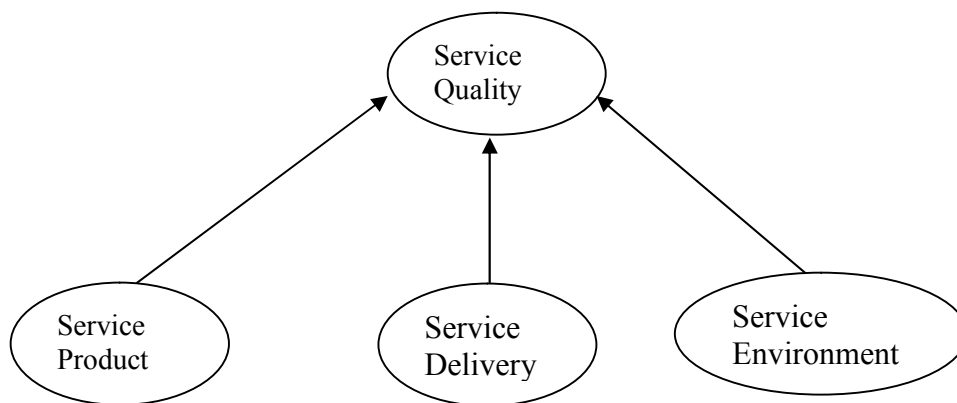
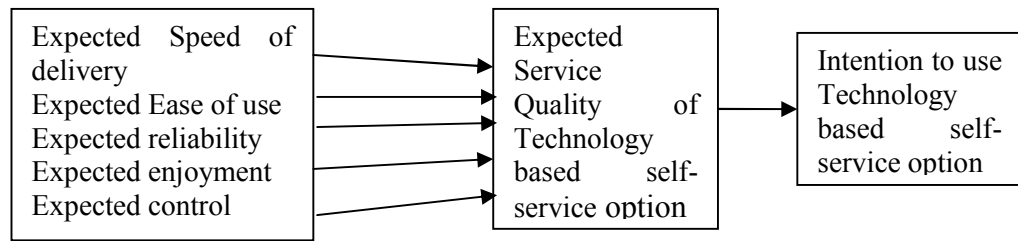


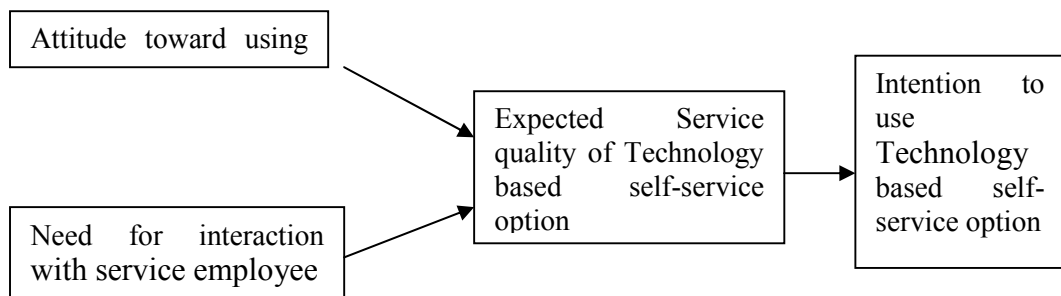
Figure 2.3: Three-Component Model (Rust and Oliver, 1993)

According to Dabholkar et al. (1996) SERVQUAL can be applied to determine the service quality offering of any service firm and the instrument has been extensively adopted. He proposed two alternative models of service quality for technology-based self-service options like the attribute model (what customers would expect service) and the overall effect model (consumers' feeling towards the use of technology). The models are shown in figure 2.4:





The attribute model



The overall effect model

Figure: 2.4: Models of Dabholkar et al. (1996)

According to Sweeney et al. (1996), the influence of service quality on value and willingness to buy in a specific service encounters through two alternative models.

Value construct used in this model is “value for money”.

Model 1: This model highlights that in addition to product quality and price perceptions, functional service quality and technical service quality perceptions both directly influence value perceptions.

Model 2: This model highlights that in addition functional service quality perceptions directly influence consumers’ willingness to buy. Functional service quality perceptions also influence technical service quality perceptions, which in turn influence product quality perceptions and neither of the two directly influence value perceptions.

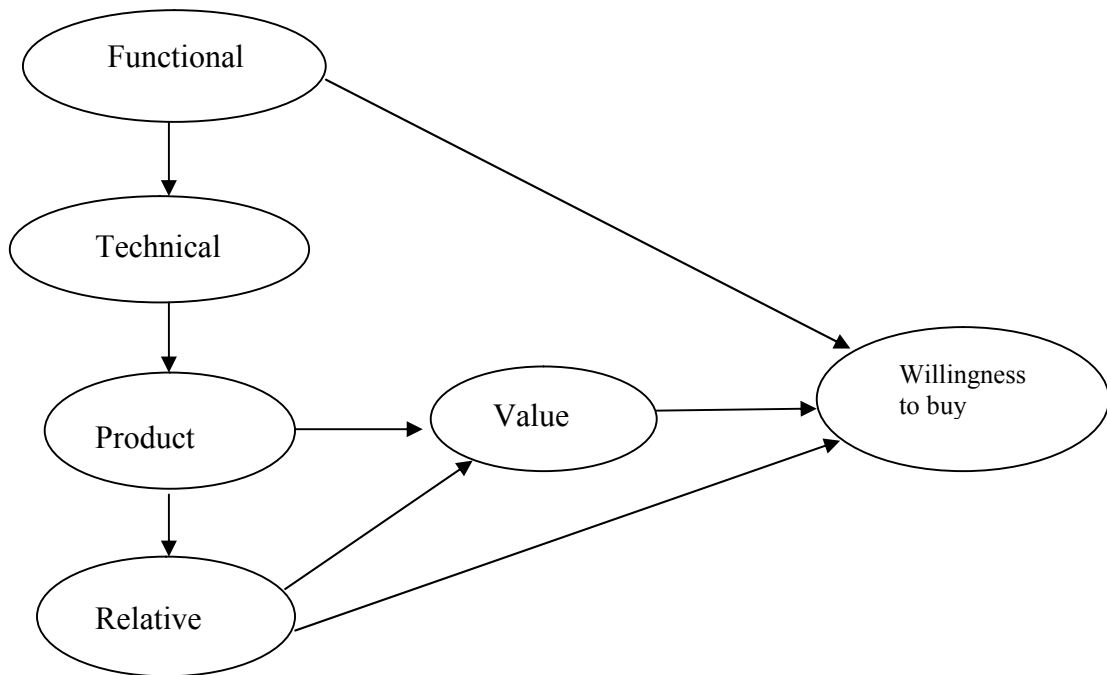


Figure: 2.5: Models of Sweeney et al. (1996)

Getty and Thompson (1995) introduced another specific model for hotel settings, called LODGQUAL which identified three dimensions, namely tangible, reliability and contacts. O' neill et al, (2000) developed DIVEPERF model for assessing perceptions of diving services where the model consists of five SERVQUAL dimensions and 27 items. Bahia et al. (2000) proposed a scale that was called Bank Service Quality (BSQ). It comprises 31 items classified across six dimensions as: effectiveness and assurance, access, price, tangibles, range of services offered and accuracy and reliability. Glaveli et al. (2006) stated that BSQ is more reliable than SERVQUAL.

Othman and Own (2001) have offered a model called CARTER, consisting of Complaint, Assurance, Reliability, Tangibles, Empathy, and Responsiveness which includes 34 components. ECOSERV was introduced by Khan (2003) to measure service quality expectations in eco-tourism using 30 items and five SERVQUAL

dimensions. All of these models represent modifications of SERVQUAL Model aimed to improve the original methodology.

But the question of whether service quality should be measured as the difference between customers' perceptions and expectations, or whether some alternative approach is more appropriate remains part of an extensive debate in service quality literature. Jain et al. (2004) called into question the conceptual basis of the SERVQUAL, having found it, led to confusion with service satisfaction. They discarded the 'E' for 'expectation' claiming instead that 'P' for 'performance' alone should be used. SERVPERF model explains more of the variation in service quality than SERVQUAL and had an excellent fit in four industries. Several authors used the performance-only approach to assess service in tourism and hospitality settings. Travelers' perceptions of hotel attributes were measured in Hong Kong's Hotels by Choi and Chu (2001), and Malaysian hotels by Poon and Lock-Teng Low (2005). But till date, it is unclear as to which of SERVQUAL and SERVPERF is superior in measuring service quality (Jain et al., 2004).

Despite these, there is general agreement that SERVQUAL items are reliable predictors of overall service quality (Khan, 2003). Cook and Thompson (2000) investigated that SERVQUAL displayed three responsive dimensions like responsive, empathy and assurance dimensions. Nitecki and Herson (2000) used SERVQUAL to assess library services at Yale University and found that reliability the most important and empathy least important among the five quality dimensions. Al Tamimi and Al Amiri (2003) compared the five dimensions of SERVQUAL between the two main Islamic banks of UAE; Abu Dhabi Islamic Bank, and Dubai Islamic bank and found out that reliability was the most important dimension of their instrument. Wilkins et al. (2007) explored three important aspects of service quality in hotel industry which

are psychical product, service experience and quality food & beverages. Moreover, the five dimension of SERVQUAL model has been proven to be the main yardstick used by most of the researchers in the evaluation of service quality (Wilson et al., 2008; Bennett & Barkensjo, 2005; Negi, 2009; Wang & Lo, 2002). This idea generates an assumption that each of the five dimensions of SERVQUAL model could have a direct relationship with service quality.

Website service quality depends on usability, usefulness of content, adequacy of information, accessibility, and interaction (Yang et al., 2004). Berndt (2009) identified five factors associated with servicing in motor industry in South Africa as customer-focused quality, tangibles, deliver quality, communication quality and customer care quality.

Gunarathne (2014) also identified five tourism service quality dimensions, namely, tangibility, reliability, responsiveness, assurance and empathy, all of which comprise the criteria tourists use to evaluate the service quality of Sri Lankan hotels. These results support the idea that despite the usefulness of the SERVQUAL scale as a concept, it should be adapted for the service environment as well.

Although it is apparent that perceptions of service quality are based on multiple dimensions, there is no general agreement as to the nature or content of the dimensions. Because service quality has a distinct constructs and distinguished features for different services. The Studies examining relationship of Service quality dimensions with customer satisfaction is stated in Table 2.3:

**Table 2.3: Types of Service Quality Dimensions used in Literature:**

Author(s)	Types of Service Quality Dimensions
Lehtinen and Lehtinen (1982)	Physical quality, interactive quality and corporate (image) quality.
Groenroos (1982)	Technical quality, which involves what the customer is actually receiving from the service; Functional quality, which involves the manner in which the service is delivered and Image, which can be expected to build up mainly by technical and functional quality of service.
Parasuraman et al. (1988)	Ten dimensions of service quality determinants: Reliability, Responsiveness, Competence, Accessibility, Courtesy, Communication, Credibility, Security, Understanding/ knowing the customer and Tangibility.
Parasuraman et al. (1991)	Five dimensions of service quality determinants: Tangibility, Reliability, Responsiveness, Assurance and Empathy.
Souman and van Wiele (1992)	Identified dimensions like customer kindness, tangible and faith in vehicle servicing.
Avkiran (1994)	personnel's contact, reliability, communication, and access to services
Getty and Thompson (1994)	LODQUAL which identified three dimensions, namely tangible, reliability and contacts.
Stevens, Knutson and Patton (1995)	DINESERV which contains 29 items and five SERVQUAL dimensions.
Johnson et al. (1995)	Materials, facilities and Personnel
Dabholkar et al. (1996)	Expected Speed of delivery, Expected Ease of use, Expected reliability, Expected enjoyment and Expected control.
Sweeney et al. (1996)	Functional Service Quality, Technical Service Quality, Product Quality and Relative Price.
Mei, Dean and White (1999)	HOLSERV model which identified three dimensions like employees, tangibles and reliability. The model includes 27 items, grouped in five original SERVQUAL dimensions.
O'neill et al, (2000)	DIVEPERF model for assessing perceptions of diving services with five SERVQUAL dimensions and 27 items.
Bahia and Nantel (2000)	Bank Service Quality (BSQ) comprised of 31 items classified across six dimensions as: effectiveness and assurance, access, price,

	tangibles, range of services offered and accuracy and reliability.
Cook and Thompson (2000)	Investigated that SERVQUAL displayed three responsive dimensions like responsive, empathy and assurance dimensions.
Nitecki and Herson (2000)	SERVQUAL to assess library services reliability the most important and empathy least important among the five quality dimensions.
Own (2001)	CARTER consists of Complaint, Assurance, Reliability, Tangibles, Empathy, and Responsiveness which includes 34 components.
Khan (2003)	ECOSERV to measure service quality expectations in eco-tourism using 30 items and five SERVQUAL dimensions.
Al Tamimi and Al Amiri (2003)	Compared the five dimensions of SERVQUAL between the two main Islamic banks of UAE; Abu Dhabi Islamic Bank, and Dubai Islamic bank and found out that reliability was the most important dimension of their instrument.
Laroche et al., (2004)	Technical and functional dimensions.
Fames (2004)	Functional and technical quality influence perceptions of overall service quality. They found the importance of image on mediating an individual's perception of overall service quality.
Yang et al. (2005).	Website service quality depends on usability, usefulness of content, adequacy of information, accessibility, and interaction
Wilkins et al. (2007)	Three important aspects of service quality in hotel industry which are psychical product, service experience and quality food & beverages.
Berndt (2009)	Five factors associated with servicing in motor industry in South Africa as customer-focused quality, tangibles, deliver quality, communication quality and customer care quality.
Umesh (2014)	Five tourism service quality dimensions, namely, tangibility, reliability, responsiveness, assurance and empathy to evaluate the service quality of Sri Lankan hotels.

## **2.3 Review of Literature on Perceived value**

Perceived value is claimed to be a major tool to help the service provider to gain a better competitive position in the market (Woodruff, 1997; Huber et al., 2001; Stahl et al., 1999). Cronin et al. (2000) showed in their study that perceived value is the most significant factor for repurchase intention. Only few researches have investigated the antecedents and the consequences of perceived service value in detail. But to develop a long-term relationship with customers, perceived service value is very important for managers of business. The likelihood that the buyer intends to purchase the product is positively related to overall perceptions of acquisition value and transaction value (Monroe and Chapman, 1987 and Zeithmal, 1988). Ladhari and Morales (2008) argued that though it is a very important concept. Cronin et al. (2000) studied that perceived value is the most significant factor for repurchase intention.

Perceived value has its root in equity theory, which considers the ratio of the consumer's outcome/input to that of the service provider's outcome/input (Oliver & DeSarbo, 1988). The equity concept refers to customer evaluation of what is fair, right or deserved for the perceived cost of the offering. Perceived cost include monetary payments and nonmonetary sacrifices such as time consumption, energy consumption, and stress experienced by customers. In turn, customer-perceived value results from an evaluation of the relative rewards and sacrifices associated with the offering. Customers are inclined to feel equitably treated if they perceive that the ratio of their outcome to inputs is comparable to the ratio of outcome to inputs experienced by the company (Oliver & DeSarbo, 1988). And customers often measure a company's ratio of outcome to inputs by making comparisons with its competitors' offerings.

Grewal et al. (1989) stated that buyers' perception of value "represents a trade-off between the quality and benefits they perceived in the product relative to the sacrifice they perceive by paying the price" He expressed perceived value as:

$$\text{Perceived Value} = \frac{\text{Perceived benefits}}{\text{Perceived sacrifice}}$$

The earliest work on psychological and behavioral concepts relevant to perceived value was Zeithaml's (1988) model that proposed perceived value in monetary terms and presented four dimension of perceived value such as low price, whatever customer want in a product, quality received for the price paid and what customer get for what they gave. These four definitions have been brought together and perceived value has been defined as the consumers' overall assessment of the utility of a product based on perceptions of what is received and what is given.

Anderson et al. (1993) defined perceived value in business contexts as "the perceived worth in monetary units of the set of economic, technical, service and social benefits received by a customer firm in exchange for the price paid for a product offering, taking into consideration the available suppliers' offerings and prices." From the customer perspective, perceived value is the ratio of benefits to the sacrifices necessary to obtain those benefits (Naumann, 1995).

In the past literature perceived value is usually operationalized using a single item scale which aims to capture customers' overall value judgement on a statement (e.g. the hotel is good/bad value for money) (Kashyap and Bojanic 2000; Oh 1999).

Different authors present different dimensions to measure perceived value.

However, such practice suffers from two apparent shortcomings. Firstly, that approach fails to reflect the widely accepted theoretical definition of perceived value which states that it is the consumer's overall assessment of the utility of a product



based on perceptions of what is received and what is given (Zeithaml 1988). By implication, perceived value is a trade-off between two components; benefits and sacrifices. The former is known as get component (what customers get from a product) and the latter is known as give component (what customers give in order to get a product; usually refers to the money paid) (Kotler et al., 1999; Naumann 1995). Secondly, the concept of perceived value is proposed to be multi-dimensional and therefore the use of a single item scale would not capture dimensions of this construct adequately.

Perceived value is consisted of two dimensions called acquisition value and transaction value. Acquisition value is perceived net gains associated with the products and services acquired in consumption (Grewal et al., 1998 and Zeithmal, 1988). Acquisition value has a close relationship with the perceived benefits as well as perceived sacrifices. Hence it is positively influenced by the product benefits and negatively influenced by the money given up to obtain the product. Scholars argue that the most important element of this get component is perceived quality (Grewal et al. 1998; Parasuraman and Grewal 2000). Transaction value is defined as the difference between consumers' internal reference price and the price offered within the context of a special price deal (Grewal et al. 1998). From the customer point of view, a deal is assessed by comparing the selling price to his/her internal reference price. Therefore, a customer, on examining the financial terms of the price offer, might perceive additional value beyond that provided by acquisition value. Thus, transaction value can be conceptualized as the psychological satisfaction or pleasure obtained from taking advantage of the financial terms of the price deal. This distinction between acquisition value and transaction value is particularly important when considering the impact of perceived value on consumers' willingness to buy,

information seeking behavior and/or comparing alternatives. Grewal et al. (1998) argue that the influence of transaction value on behavioral intentions is mediated by acquisition value. The likelihood that the buyer intends to purchase the product is positively related to overall perceptions of acquisition and transaction value (Zeithaml, 1988).

A few efforts have been done for measuring the perceived value construct (Grewal et al. 1998; Sweeney et al. 1996). Measurement of perceived value has seen both qualitative to quantitative approaches (Al-Sabbahy et al., 2003; Kashyap & Bojanic, 2000; Duman, 2002). This is largely because of the totality of the concept when viewed in comparison with relatively more narrow constructs such as satisfaction or service quality. Zeithaml (1988) used a qualitative approach to explore perceived value in beverages. Grewal et al. (1998) stated that past research has not addressed the conceptual distinction between acquisition and transaction value. Therefore they made an effort to test the validity of these two dimensions with two empirical studies. Their research was experimental and concerned with perceived product value and customers' choice behavior in the pre-purchase phase.

In the studies by Cronin et al. (1997) and Patterson and Spreng (1997), overall perception of value was measured by uni-dimensional scales in which a limited number of items were used to determine value.

Sweeney & Soutar (2001) developed the first meaningful scale of items ascertaining that perceived value was four dimensional construct across functional (quality & performance), functional (price), emotional and social. They developed the first multi-dimensional scale of perceived value which is known as PERVAL. All these four elements are related to the potential purchase of durable goods in a retail setting. They found that emotional value is more important as related to functional value in durable

goods. They provide suggested four sub dimensions of perceived value which are following in table 2.4:

**Table 2.4: Sub Dimensions of Perceived Value of PERVAL:**

Emotional value	“the utility derived from the feelings or affective states that a product generates”
Social value (enhancement of social self-concept)	“the utility derived from the product’s ability to enhance social self-concept”
Functional value (price/value for Money)	“the utility derived from the product due to the reduction of its perceived short term and longer term costs”
Functional value (performance/quality)	“the utility derived from the perceived quality and expected performance of the product”

Source: Sweeney & Soutar (2001)

Mathwick, Malhotra, & Rigdon (2001) developed EVS to assess consumer experiential value in the catalog and internet shopping setting and include Visual appeal, entertainment, escapism, enjoyment, efficiency and economic value factors.

Uлага and Chacour (2001) and Woodall (2003) identified perceived value as the trade-off between benefits and sacrifices perceived by customers in a supplier's offering.

Petric (2002) presented, tested and validated another multi-dimensional perceived value scale named SERV- PERVAL with five dimensional constructs namely quality, monetary price, non-monetary price, reputation and emotional response to assess customer perceived value in luxury cruises service context. Later (2004) he argued that the lack of studies on the customer perceived value is highly due to a limited number of well-developed scales of the construct.

In the hospitality and travel context, Al-Sabbahy et al. (2003) attempted to develop a two dimensional scale for both hotels and restaurants. From the study it was found that the correlation between the total acquisition value and total transaction value scores was high for both the hotels and restaurants. On the other hand, the correlation between both of the perceived value scales on the one side, and repurchase intention and recommendation intention on the other side is strong. This means that behavioral intentions can be predicted by measuring perceived value of hotels.

Walker et al. (2006) considered perceived value as customer recognition and appreciation the utility of a product that is given by a service provider which may fulfill his/her expectation.

According to Yang and Peterson (2004), perceived value is the ratio of benefits received from providers relative to the costs sacrificed by customers. It is a variable that reflects the net utility derived from a provider.

Beldona and So (2004) explored that convenience makes up for the strongest association with high perceived value in a travel vacation club membership.

According to Lim et al (2006) three value dimensions – economic, emotional, and social values - are treated as the most relevant to mobile service experience. Economic value is related to perceived economic benefits received by users of mobile phone services in comparison to the monetary cost of the services. Emotional value is the utility derived from the feelings or affective states that a product/service generates. Social value is the utility derived from the product's or service's ability to enhance social self-concept. Perceived value is a kind of gain where a customer obtains in return for the paid cost (Gallarza & Saura, 2006).

Rintamäki et al. (2006) identified three broad constructs of customer perceived value; “utilitarian, Social and hedonic”. Utilitarian component is like functional value as

defined by other authors. Social value is related with status and self esteem and hedonic is related with emotional value of person. Chen and Tsai (2008) stated that perceived value assessment includes social psychological perspective and non monetary costs such as search cost, transaction cost, negotiation cost, and consumption of time. According to Rizwan et al. (2014) service quality positively affect customer satisfaction with perceived value acting as a moderating variable.

Therefore, perceived value is a more holistic concept that encompasses the entire product or service.

## **2.4 Review of Literature on Customer Satisfaction**

Customer satisfaction is regarded as the heart of all marketing activities. So, service providers and scholars have long recognized the importance of customer satisfaction as contributing to market share and return on investment for companies. In particular, researchers have found that enhancing customer satisfaction will drive to higher future profitability and develop customer loyalty (Fornell, 1992). Customer satisfaction is increasingly becoming corporate goal as more and more companies strive for high quality in their products and services, with a view to eventually succeed in satisfying their customers (Bitner & Hubbert, 1994).

In a turbulent commerce environment, in order to sustain the growth and market share, companies need to understand how to satisfy customers, since customer satisfaction is critical for establishing long-term client relationships (Patterson et al. 1997).

According to Machleit and Mantel (2001), the principal purpose of marketing in services is to satisfy customer needs and wants. The ability to satisfy customer is essential in service industry due to the fact that satisfied customer will reward the firms with favorable behaviors. Customer satisfaction is a key factor in formation of customer's desires for future purchase (Mittal & Kamakura, 2001).

Several definitions and models of customer satisfaction have been proposed by various scholars. Early concepts of satisfaction research have typically defined satisfaction as a post choice evaluative judgment concerning a specific purchase decision (Oliver 1980). According to him customer satisfaction is a psychological state resulting when the emotion surrounding disconfirmed expectations is coupled with the consumer's prior feelings about the consumption experience. His customer

satisfaction model explains that when the customers compare their perceptions of actual products/services performance with the expectations, then the feelings of satisfaction have arisen. Any discrepancies between the expectations and the performance create the disconfirmation. He identified three types of disconfirmation. These are:

- Positive disconfirmation occurs when Product/service performance  $<$  expectations.

In this case, the customers are highly satisfied.

- Negative disconfirmation occurs when Product/service performance  $<$  expectations.

In this case, the customers are highly dissatisfied.

- Zero disconfirmation occurs when Product/service performance = expectations.

Customer satisfaction is an overall attitude towards a service provider (Levesque and McDougall, 1996).

In 1997, Oliver et al. built on his earlier definition and re-defined customer satisfaction as “the customer’s fulfillment response. It is a judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption-related fulfillment”. They refer to this “comfort” level as contentment which is a passive response and the customer is not involved emotionally.

Parasuraman et al. (1988) suggested that customer satisfaction is based on multiple factors rather than one factor. They came up with five dimensions to measure service quality such as tangibles, reliability, responsiveness, assurance and empathy. Using a five-dimension scale composed of 21 service attributes, the SERVQUAL survey measures the gaps between customer perceptions and expectations.

Customer satisfaction is the outcome of customer's perception of the value received in a transaction or relationship, where value equals perceived service quality, compared to the value expected from transactions or relationships with competing vendors (Blanchard & Galloway, 1994; Zeithaml et al., 1990).

According to Fornell (1992) Satisfaction is an overall post-purchase evaluation by the consumer.

Giese and Cote (2000) identified the following components of satisfaction:

- Customer satisfaction is one kind of response (cognitive or emotional)
- The response emphasizes on a particular focus (product, consumption experience, expectations etc.)
- The response occurs at a particular time (after choice, based on accumulated experience, after consumption etc.)

Concept of expectations is the standard against performance outcomes (Szymanski and Henard, 2001). Therefore, if consumer's actual outcomes exceed expectations, the consumer will be considered as satisfied otherwise if expectations exceed outcomes, consumer will be considered as dissatisfied (Szymanski and Henard, 2001).

Giese & Cote (2000) stated that customer satisfaction is identified by a response (cognitive or affective) that pertains to a particular focus (i.e. a purchase experience and/or the associated product) and occurs at a certain time (i.e. post-purchase, post-consumption)" This definition is supported by some other authors, who think that consumer's level of satisfaction is determined by his or her cumulative experience at the point of contact with the supplier (Sureshchander et al., 2002). Customer satisfaction has also been defined as the extent to which a product's perceived performance matches a buyer's expectations (Kotler et al., 2002).



Anderson and Srinivasan (2003) defined customer satisfaction as the contentment of the customer with respect to his or her prior purchasing experience with a given service firm. It is a judgment that a product or service feature, or the product or service itself, provide a pleasurable level of consumption-related fulfillment.

According to Schiffman & Kanuk (2004) Customer satisfaction is defined as “the individual’s perception of the performance of the products or services in relation to his or her expectations”. The feeling of satisfaction is not at “comfort” level, which, according to Andersson and Mossberg (2004), is defined as the level of satisfaction without the feeling of being excited.

In a nutshell, customer satisfaction could be the pleasure obtained from consuming an offer. Measuring customer satisfaction could be very difficult at times because it is an attempt to measure human feelings.

The performance-only approach measures transactional-specific satisfaction (Nicholls et al., 1998). A method widely reported in research of the performance-only approach is the customer satisfaction survey. This instrument assesses satisfaction after a service encounter using measures of service quality and customer satisfaction.

According to Vargo et al. (2007), satisfiers are concerned with the intrinsic needs of the customer while dissatisfiers meet the extrinsic needs of the customer or their functional requirements. This suggests that the basic needs of the customer must be taken care first, and intrinsic needs be provided subsequently, for him or her to experience customer satisfaction.

Moliner et al. (2007) identified Satisfaction as the consumer’s good judgment about pleasure versus displeasure. They pointed out two ways:

- 1) Cognitive nature (which is the comparison between expectations and performance) and
- 2) Affective nature (association with feeling of pleasure).

According to Bitner et al. (2010), satisfaction is often connected with the feeling of “delight” which is described as “being surprised in a positive way” or “relief” when a negative feeling of a customer who had a bad experience is removed by service recovery. In order to achieve customer satisfaction, it is important to recognize and to anticipate customers' needs and to be able to satisfy them. Given the nebulous and complex nature of customer satisfaction, its measurement is not an exact science and research in this area seems rather exploratory (Gilbert & Veloutsou, 2006). There is no commonly agreed method of measuring the concept and several theories of measuring customer satisfaction have been proposed by scholars. Enterprises which are able to rapidly understand and satisfy customers' needs, make greater profits than those which fail to understand and satisfy those (Barsky & Nash, 2003).

## **2.5 Review of Literature on Relationship between Service Quality Dimensions and Customer Satisfaction**

Quality of service and customer satisfaction is critical factors for success of any business (Gronoos, 1990; Parasuraman et al., 1988). The key to achieve sustainable advantage lies in delivering high quality service that results in satisfied customers (Shem well et al., 1998). Service quality and customer satisfaction are key factors in the battle to obtain competitive advantage and customer retention. According to Zeithmal et al. (2004), customer satisfaction is a broader concept than service quality which “focuses specifically on dimensions of service”.

It has been proven from past researches on service quality and customer satisfaction that Customer satisfaction and service quality are related. Some authors have agreed to the fact that service quality determines customer satisfaction. Parasuraman et al. (1985) in their study proposed that when perceived service quality is high, then it will lead to increase in customer satisfaction.

Bolton and Drew (1994) point out “customer satisfaction depends on pre-existing or contemporaneous attitudes about service quality.” Hence, it has been suggested that improved service quality will result in a satisfied customer and suggest that to a large extent this relationship is intuitive (Bitner & Hubbert, 1994).

Oliver's model integrates the two constructs, and suggests, among other things, that perceived service quality is an antecedent to satisfaction. Ruyter et al. (1997) also showed that service quality should be treated as an antecedent of service satisfaction. The relationship among service quality and customer satisfaction has received considerable attention in the marketing literature (Cronin and Taylor, 1992; Zeithaml et al., 1996; Meuter et al., 2000; Brady et al., 2001; Olorunniwo et al., 2006). Several

studies showed that service quality may indirectly and directly affect customer satisfaction. Bitner (1990) examined that service quality had been an important antecedent of tourist satisfaction. Cronin and Taylor (1992) identified that service quality is a determinant of customer satisfaction, because service quality comes from outcome of the services from service providers in organizations. Oliver (1993) suggested that service quality would be antecedent to customer satisfaction regardless of whether these constructs were cumulative or transaction-specific.

Other researchers had proven also that there is a relationship between customer satisfaction and service quality (Sivadas & Baker-Prewitt, 2000; Wang et al., 2002; Kuo, 2003, Liang & Zhang, 2009). Saravana & Rao (2007) and Lee and Lambert (2000) acknowledged that customer satisfaction is based upon the level of service quality that is provided by the service providers. Lewis, (1993), Sivadas & Baker-Prewitt (2000) examined that service quality influences relative attitude and satisfaction with department stores.

Chien et al. (2002) found that customer satisfaction and service quality are related, confirming the definitions of both variables which have always been linked. They also dictated that service quality is more abstract because it may be affected by perceptions of value or by the experiences of others that may not be so good, than customer satisfaction which reflects the customer's feelings about many encounters and experiences with service firm (Su et al., 2002). Sureshchandar et al. (2002) investigated that service quality and customer satisfaction are indeed independent, but are closely related, implying that an increase in one is likely to lead to an increase in the other. González and Brea (2005) and Ekinçi and Sirakaya (2004) using recursive structural models provided empirical support that service quality results in customer satisfaction. Wilson and Todd (2008) presented a situation that service quality is a

focused evaluation that reflects the customer's perception of reliability, assurance, responsiveness, empathy and tangibility while satisfaction is more inclusive and it is influenced by perceptions of service quality, product quality and price, also situational factors and personal factors.

Firms that provide superior service quality also have a more satisfied customer base (Gilbert et al., 2004; Gilbert and Veloutsou, 2006). Agus et al. (2007) confirmed that relationships between service quality and customer satisfaction exist. Jamali (2007) also found a positive relationship between service quality and customer satisfaction. Ko et al. (2008) suggests that empathy, assurance and tangibles are important service dimensions of service quality, which could lead to high customer satisfaction in fine dining restaurants in Singapore. According to Hutchinson et al. (2009) when customers get expected service quality, it leads to higher satisfaction.

Zaim et al (2010) find out that tangibility, reliability and empathy are important factor for customer satisfaction, whereas responsiveness and assurance are important factor, found by Mengi (2009). Kumar et al. (2010) and Lai (2004) found that assurance, empathy and tangibles are the important factor.

Most of the researchers found that Service quality is an antecedent of the broader concept of customer satisfaction (Gotlieb et al., 1994; Zeithaml et al., 1996; Lee et al., 2000; Bedi, 2010; Kassim and Abdullah, 2003; Kumar et al., 2010; Naeem and Saif, 2009; Balaji, 2009; Lee and Hwan, 2005; Athansopoulos and Iliakopoulos, 2003).

Yee et al. (2010) found that service quality has a positive influence on customer satisfaction.

Siddiqi (2010) also confirmed that all the service quality attributes are positively correlated with customer satisfaction.

To crown the fact that customer satisfaction and service quality are important variables in business research on customers, Gera (2011) investigated Service quality was found to significantly impact on customer satisfaction and value perceptions (Gera, 2011). Moreover according to Zeithmal et al. (1996) perceived service quality is a component of customer satisfaction. Figure 2.6 graphically illustrates the relationships between the two concepts. Here service quality is a focused evaluation that customer’s perception of reliability, assurance, responsiveness, empathy and tangibles. Satisfaction, on the other hand, is more inclusive: it is influenced by perceptions of service quality, product quality and price, as well as situational factors (like family member opinions) and personal factors (like customer’s mood or emotional state). Relationships between the perceived service quality and customer satisfaction is shown in figure 2.6:

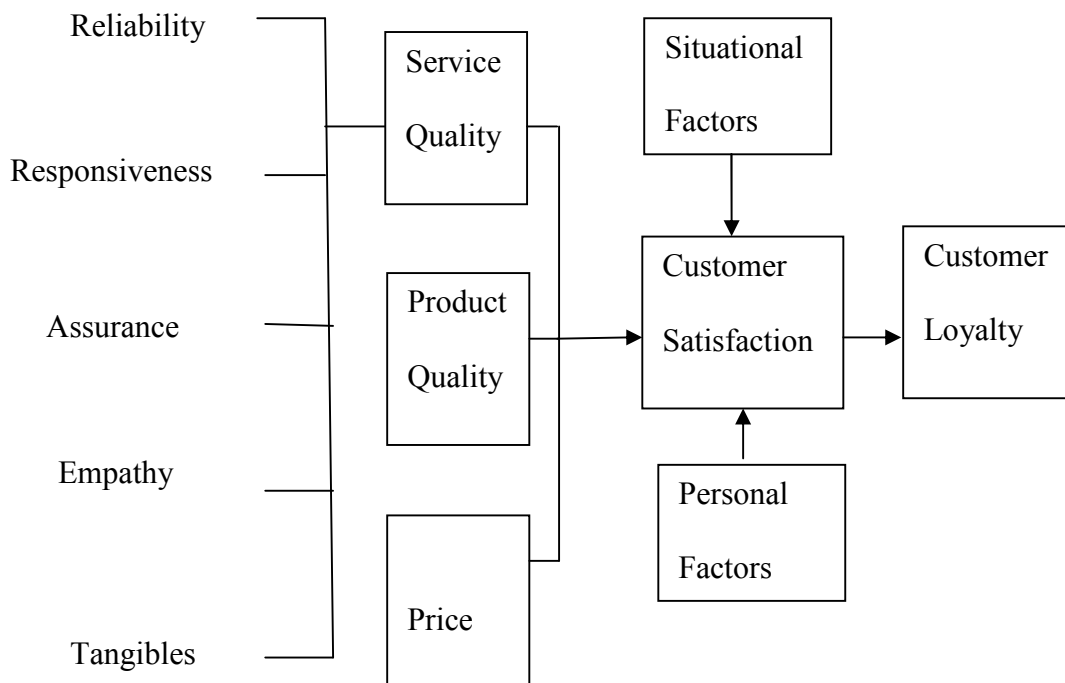


Figure 2.6: Customer perceptions of Quality and Customer satisfaction (Zeithmal et al., 1996)

Ogunnaike and Olaleke (2010) discovered that the degree of customer satisfaction can be determined by four identified variables as prompt service, employees' willingness to listen to complaints, effective customer service and employees and friendliness.

Reliability, responsiveness-empathy and tangibles were also the explanatory variables in predicting customer satisfaction for Greek Cypriot bank customers (Arasli et al., 2005).

Culiberg and Rojšek (2010) identified four factors as service quality dimensions as antecedents to customer satisfaction in retail banking which are: Assurance and Empathy; Reliability and Responsiveness; Access and Tangibles.

The reviewed literature is summarized in table 2.5 showing service quality dimensions have emerged as a multi-dimensional construct affecting customer satisfaction.

**Table 2.5: Review of Literature on Relationship between Service Quality Dimensions and Customer Satisfaction**

<b>Author(s)</b>	<b>Major Findings</b>
Parasuraman et al. (1985)	When perceived service quality is high, then it will lead to increase in customer satisfaction.
Bitner (1990)	Service quality had been an important antecedent of tourist satisfaction.
Cronin and Taylor (1992)	Service quality is a determinant of customer satisfaction, because service quality comes from outcome of the services from service providers in organizations.
Oliver (1993)	Service quality would be antecedent to customer satisfaction regardless of whether these constructs were cumulative or transaction-specific.
Lewis (1993)	Three dimensions of service quality: tangibles, responsiveness and empathy are significant predictors of customer satisfaction.
Gotlieb et al. (1994)	Service quality is an antecedent of the broader concept of customer satisfaction
Bolton and Drew (1994)	Customer satisfaction depends on pre-existing or contemporaneous attitudes about service quality.
Bitner & Hubbert (1994)	Improved service quality will result in a satisfied customer and suggest that to a large extent this relationship is intuitive.
Zeithaml and Bitner (1996)	Service quality is an antecedent of the broader concept of customer satisfaction
Buttle (1996)	Service quality is an antecedent of the broader concept of customer satisfaction
Spreng and Mackoy (1996)	Service quality leads to satisfaction.
Shemwell et al. (1998)	The key to achieve sustainable advantage lies in delivering high quality service that results in satisfied customers
Lee et al. (2000)	Customer satisfaction is based upon the level of service quality that is provided by the service providers.
Sivadas & Baker-Prewitt (2000)	Service quality influences relative attitude and satisfaction with department stores.
Caruana et al. (2000)	Service quality positively correlated with perceived value of audit



	firms.
Su et al. (2002)	Customer satisfaction and service quality have always been linked.
Sureshchandar et al. (2002)	Service quality and customer satisfaction are indeed independent, but are closely related, implying that an increase in one is likely to lead to an increase in the other.
Athanassopoulos and Iliakopoulos (2003)	Service quality is an antecedent of customer satisfaction.
Ekinci (2004)	Provided empirical support that service quality results in customer satisfaction.
Gilbert et al. (2004)	Provide superior service quality also has a more satisfied customer base.
Lai (2004)	Assurance, empathy and tangibles are the important factor for customer satisfaction.
Zeithmal et al. (2004)	Perceived service quality is a component of customer satisfaction.
González and Brea (2005)	Provided empirical support that service quality results in customer satisfaction.
Arasli et al. (2005)	Reliability, responsiveness-empathy and tangibles were also the explanatory variables in predicting customer satisfaction for Greek Cypriot bank customers
Gilbert and Veloutsou (2006)	Provide superior service quality also has a more satisfied customer base.
Andaleeb and Conway (2006)	Reported the positive relationship between customer satisfaction and service quality.
Saravanan & Rao (2007)	Customer satisfaction is based upon the level of service quality that is provided by the service providers.
Agus et al. (2007)	Relationships between service quality and customer satisfaction exist.
Jamali (2007)	Found a positive relationship between service quality and customer satisfaction.
Ko King Lily Harr (2008)	Empathy, assurance and tangibles are important service dimensions of service quality which could lead to high customer satisfaction in fine dining restaurants in Singapore.
Hutchinson et al. (2009)	When customers get expected service quality, it leads to higher satisfaction.

Mengi (2009)	Responsiveness and assurance are important factor for customer satisfaction.
Balaji (2009)	Service quality is an antecedent of the broader concept of customer satisfaction.
Kassim and Abdullah (2010)	Service quality is an antecedent of customer satisfaction.
Kumar et al. (2010)	Assurance, empathy and tangibles are the important factor for customer satisfaction.
Bedi (2010)	Service quality is an antecedent of the broader concept of customer satisfaction
Zaim et al (2010)	Tangibility, reliability and empathy are important factor for customer satisfaction.
Yee et al (2010)	Service quality has a positive influence on customer satisfaction.
Siddiqi (2010)	Confirmed that all the service quality attributes are positively correlated with customer satisfaction.
Ogunnaike and Olaleke (2010)	The degree of customer satisfaction can be determined by four identified variables as prompt service, employees' willingness to listen to complaints, effective customer service and employees and friendliness.
Culiberg and Rojšek (2010)	Assurance and Empathy; Reliability and Responsiveness; Access and Tangibles are factors as service quality dimensions as antecedents to customer satisfaction in retail banking.
Gera (2011)	Service quality was found to significantly impact on customer satisfaction and value perceptions.
Naeem and Saif (2011)	Service quality is an antecedent of the broader concept of customer satisfaction.

## **2.6 Review of Literature on Relationship between Service Quality Dimensions and Perceived Value**

Customer-perceived value has been found to be a major contributor to purchase intention (Chang and Wildt, 1994). Several scholars examined association between service quality and perceived value in their studies (Hutchinson et al., 2009; Lai et al., 2009; Wu and Liang, 2009). They found high service quality is correlated with high perceived value.

Perceived value is one of the most important elements for gaining competitive edge and is considered to be a significant predictor of customer satisfaction and loyalty (McDougall and Levesque, 2000; Cronin et al., 2000). Gallarza and Saura (2006) explore the relationship between perceived value, satisfaction and loyalty in tourism.

The results of their study indicate that perceived value is significantly related to tourist satisfaction.

Numerous authors (Cronin et al., 2000; Petrick, 2002, 2004) closely examine the relationship between perceived quality and perceived value. The results of their researches show that higher perceived quality typically leads to higher perceived value (e.g., Sweeney et al., 1999), and the relationship between both concepts is positive. Furthermore, results from tourism industry studies show that quality is a direct antecedent, as well as the best predictor, of perceived value (Petrick, 2004). This finding is congruent with past research, which shows that quality, not price, is the leading determinant of perceived value for services (Bolton and Drew, 1991).

By studying luxury hotel-restaurant industry in Taiwan Wu and Liang (2009) found a positive relationship between service quality aspect and experiential well as perceived value. They also stated that, to increase customer experiential value hotel managers

should emphasize on three quality aspects including service environment, employee service performance, and interaction with clients.

Lai et al. (2009), and Turel and Serenko (2006) studied relationship between service quality and perceived value along with other constructs in mobile phone service industry and found service quality positively motivate perceived value. Service quality is found as an antecedent of value perceptions by Hutchinson et al. (2009).

Frank and Enkawa (2007) revealed that consumer satisfaction can be raised in two ways: either by delivering higher consumer-perceived quality at the same price or by delivering the same quality at a lower price.

According to, Chen and Chen (2010), experience about service quality positively and significantly persuade perceived value of a customer.

Milfelner et al. (2011) studied that: (a) the relationship between perceived hotel quality and perceived value is strong and positive; (b) the relationship between hotel quality and guest satisfaction is not direct, but rather indirect through the perceived value; (c) hotel image is significantly positively related to perceived value and perceived hotel quality; and (d) perceived value strongly impacts hotel guest satisfaction. They developed a model that is presented in Figure 2.7.

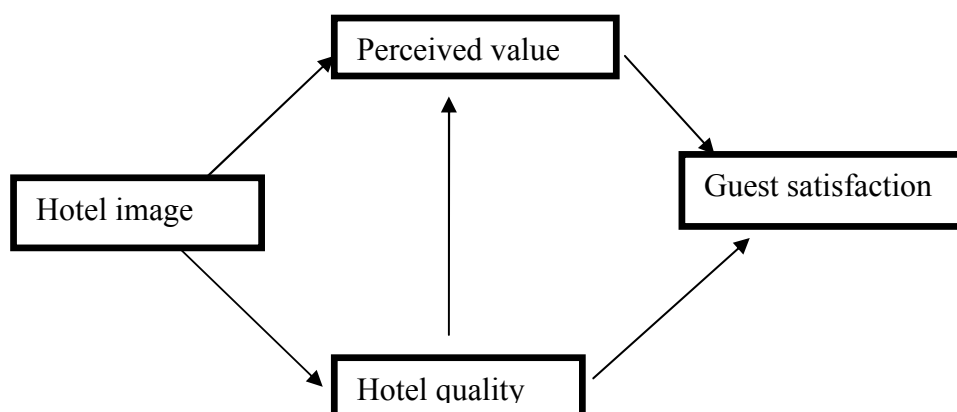


Figure: 2.7 Model by Milfelner et al. (2011)

Raza et al. (2012) found significant relationship between service quality dimensions and perceived value dimensions.

So the reviewed literature showed that service quality has emerged as a multi-dimensional construct affecting perceived value. Studies examining relationship of Service quality dimensions with perceived value are in following table: 2.6:

**Table 2.6: Review of Literature on Relationship between Service Quality Dimensions and Perceived Value**

<b>Author(s)</b>	<b>Major Findings</b>
Bolton and Drew (1991)	Quality is the leading determinant of perceived value for services
Chang and Wildt (1994)	Customer-perceived value has been found to be a major contributor to purchase intention
Sweeney et al. (1999)	Higher perceived quality typically leads to higher perceived value
McDougall and Levesque (2000)	Perceived value is considered to be a significant predictor of customer satisfaction and loyalty
Cronin et al. (2000)	Perceived value is considered to be a significant predictor of customer satisfaction and loyalty
Petrick (2002)	Higher perceived quality typically leads to higher perceived value
Turel and Serenko (2004)	Perceived value includes the price dimension to perceived quality.
Petrick (2004)	Quality is a direct antecedent, as well as the best predictor, of perceived value
Turel and Serenko (2006)	Found service quality positively motivate perceived value.
Gallarza and Saura (2006)	Perceived value is significantly related to tourist satisfaction.
Frank and Enkawa (2007)	Consumer satisfaction can be raised in two ways: either by delivering higher consumer-perceived quality at the same price or by delivering the same quality at a lower price.
Po-Tsang Chen (2009)	Explores relationship between service quality attributes and perceived value by using five service quality dimensions like perceived service, coffee quality, beverages, atmosphere and extra benefit.
Hutchinson et al. (2009)	High service quality is found as an antecedent of value propositions.
Lai et al. (2009)	High service quality is correlated with high perceived value.
Wu and Liang (2009)	High service quality is correlated with high perceived value.
Chen and Chen (2010)	Service quality positively and significantly persuade perceived value of a customer
Milfelner et al. (2011)	Relationship between perceived hotel quality and perceived value is strong and positive;
Raza et al. (2012)	There is significant relationship between service quality dimensions and perceived value dimensions

## **2.7 Review of Literature on Relationship between Perceived Value and Customer Satisfaction**

Service providers and scholars have long recognized the importance of customer satisfaction as contributing to market share and return on investment for companies. Customer satisfaction is the outcome of customer's perception of the value received in a transaction or relationship, where value equals perceived service quality, compared to the value expected from transactions or relationships with competing vendors (Blanchard & Galloway, 1994; Zeithaml et al., 1990). On the other hand, perceived value acts as an important tool in customer satisfaction based on different studies.

Though it is a very important concept, only few researches have investigated the antecedents and the consequences of perceived service value in detail (Ladhari and Morales, 2008). Examining the issue of perceived value is important because, compared to perceived quality; perceived value is more directly linked to consumers' willingness-to-buy (Dodds and Monroe, 1985). In addition to that, a higher level of perceived service performance leads to a high level of perceived value (Lim et al, 2006). According to Schiffman and Kanuk (2004), the overall objective of providing value to customers continuously and more effectively than competitors is to have and to retain highly satisfied customers.

There is empirical evidence that customer perceived-value has a positive effect on customer satisfaction (Anderson & Mittal, 2000 and Walter et al., 2002). Takala et al. (2006) explained that perceived value both directly and indirectly influences customer satisfaction. (Petric, 2004) emphasized that perceived value is important factor related with customer satisfaction and repurchase intention. Frank and Enkawa (2007) also found the relationship between perceived value and customer satisfaction.

Turel and Serenko (2006) investigated that, the extent of satisfaction depends on extent of perceived value and higher level of perceived value lead to higher level of customer satisfaction. Chen and Chen (2010) found perceived value as the important one among the determinants of satisfaction. Raza et al. (2012) found perceived value is important and has positive relationship with satisfaction and revisit intentions.

The reviewed literature is summarized in table 2.7 showing perceived value has emerged as a multi-dimensional construct affecting customer satisfaction.



**Table 2.7: Review of Literature on Relationship between Perceived Value and Customer Satisfaction**

<b>Author(s)</b>	<b>Major findings</b>
Dodds and Monroe (1985)	Compared to perceived quality; perceived value is more directly linked to consumers' willingness-to-buy.
Takala et al. (2006)	Perceived value both directly and indirectly influences customer satisfaction.
Anderson & Mittal (2000)	There is empirical evidence that customer perceived-value has a positive effect on customer satisfaction.
Varki & Colgate (2001)	Service quality characteristics on customer satisfaction are indirectly affected by perceive value.
Walter et al. (2002)	Customer perceived-value has a positive effect on customer satisfaction.
Petric (2004)	Perceived value is important factor related with customer satisfaction and repurchase intention.
Schiffman and Kanuk (2004)	The overall objective of providing value to customers continuously and more effectively than competitors is to have and to retain highly satisfied customers.
Lim et al. (2006)	A higher level of perceived service performance leads to a high level of perceived value
Turel and Serenko (2006)	The extent of satisfaction depends on extent of perceived value and higher level of perceived value lead to higher level of customer satisfaction.
Frank and Enkawa (2007)	There is a relationship between perceived value and customer satisfaction.
Chen and Chen (2010)	Among the determinants of satisfaction perceived value is the important one
Raza et al. (2012)	Perceived value is important and has positive relationship with satisfaction and revisit intentions.

## **2.8 Review of Literature on Mediating Role of Perceived Value to Service Quality Dimensions and Customer Satisfaction**

Many authors in different theoretical and empirical studies (Patterson and Spreng, 1997; Cronin et al., 2000) conceptualize a model of perceived value as the link among quality, sacrifices and satisfaction. The results of these studies indicate that perceived value has a strong and significant effect on satisfaction (Ulaga, 2001; Cronin et al., 2000). Even though many studies have been done, little is known about the mediating effect of perceived value in service quality models (Caruana et al., 2000; Eggert and Ulaga, 2002). Eggert and Ulaga (2002) found that properly implemented service quality characteristics (i.e., reliability, responsiveness, assurance and empathy) can increase individuals' perceived value about the quality features. As a result, it might lead to an increased customer satisfaction.

Perceived value variable is considered a mediating variable between perceived quality and hotel guest satisfaction as it is often the case in other industries (e.g., Caruana et al., 2000; Cronin et al., 2000, Varki & Colgate, 2001). According to them the effect of service quality features on customer satisfaction is not consistent if perceived value is present in organizations. To identify and explore to determine whether value plays a moderating role between service quality and satisfaction among customers of an audit firm Caruana et al. (2000) has a research model shown in figure 2.8.

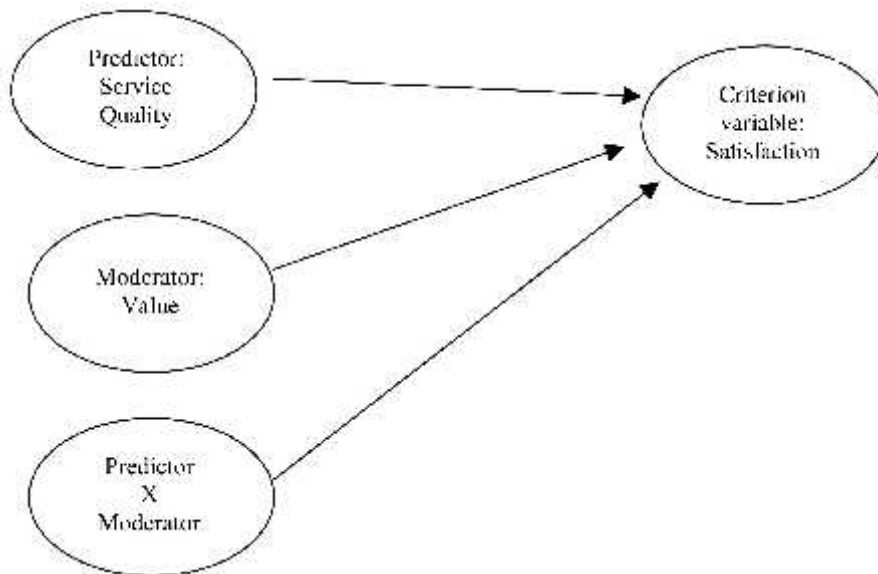


Figure 2.8: Moderating role of perceived value between service quality and satisfaction (Caruana et al., 2000)

Sureshchandar et al. (2002) stated that in a service management context, the ability of an organization to use reliability, responsiveness, assurance and empathy in delivering services will increase customers' perceptions of value; this may lead to higher customer satisfaction.

Yunus et al (2009) found that perceived value acts as a partial mediating variable in the relationship between service quality characteristics and customer satisfaction. A conceptual framework for the study is developed to find out how Perceived value mediates service quality characteristics and customer satisfaction as shown in figure 2.9:

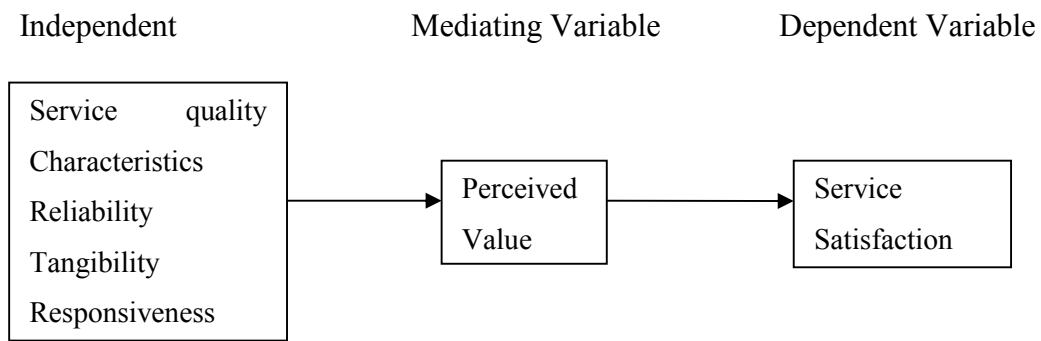


Figure 2.9: Perceive value mediates the effect of service quality characteristics and customer satisfaction (Yunus et al, 2009)

Ismail et al. (2009) studied the relationship between service quality, perceived value and satisfaction where they used three dimensions like empathy, assurance and responsiveness to service of higher studies of public institutions in Malaysia. They use perceived value as a partial moderating variable between service quality dimensions and satisfaction.

Jhandir (2012) proved that perceived value acts as a partial mediating variable in the overall between perceived service quality and customer satisfaction of service sector of Pakistan.

Chen and Tsai (2008) also found that perceived value plays mediating role between service or product quality and customer satisfaction.

Uddin and Akhter (2012) found that Service quality and fair price have indirect influence on customer satisfaction of a mass service industry (i.e., mobile phone operators) through perceive value. Perceived value has mediating role between quality, charge fairness and satisfaction.

The reviewed literature is summarized in table 2.8 showing perceived value has emerged as a mediating variable affecting service quality and customer satisfaction.

**Table 2.8: Review of Literature on Mediating Role of Perceived Value to Service Quality Dimensions and Customer Satisfaction**

<b>Author(s)</b>	<b>Major findings</b>
Caruana et al. (2000)	Service quality characteristics on customer satisfaction is indirectly affected by perceive value
Cronin et al. (2000)	Perceived value variable is considered a mediating variable between perceived quality and hotel guest satisfaction
Varki & Colgate (2001)	Service quality characteristics on customer satisfaction are indirectly affected by perceive value.
Sureshchandar, (2000) and Sureshchandar et al. (2002)	The ability of an organization to use reliability, responsiveness, assurance and empathy in delivering services will increase customers' perceptions of value; this may lead to higher customer satisfaction.
Eggert and Ulaga (2002)	Properly implemented service quality characteristics (i.e., reliability, responsiveness, assurance and empathy) can increase individuals' perceive value about the quality features. As a result, it might lead to an increased customer satisfaction.
Chen and Tsai (2008)	Perceived value plays mediating role between service or product quality and customer satisfaction
Yunus et al (2009)	Perceive value acts as a partial mediating variable in the relationship between service quality characteristics and customer satisfaction.
Ismail et al.(2009)	Perceived value as a partial moderating variable between service quality dimensions and satisfaction.
Jhandir (2012)	Perceived value acts as a partial mediating variable in the overall between perceived service quality and customer satisfaction of service sector of Pakistan.
Uddin and Akhter (2012)	Service quality and fair price have indirect influence on customer satisfaction of a mass service industry (i.e., mobile phone operators) through perceive value. Perceived value has mediating role between quality, charge fairness and satisfaction.

## **2.9 Review of literature on Solar Home System Service**

A very few studies have been found on international literature on the topic of Solar home system service. According to Kivaisi (2000), modern societies strongly depend on reliable, affordable and sustainable electricity suppliers for their development and electricity is an obligatory input in the process economic, social and industrial development of any society. Indeed, the availability of electricity is directly related to the living standard of any community. Diessen (2008) supported that, electricity is one of the ingredients for development and can revert the spiral of poverty and economic recess.

Posorski (1996) stated that, Solar PV electrification can improve the quality of life of rural households through positive impacts that cannot easily be expressed in monetary terms. Significant impacts of solar PV systems include better quality of light, car batteries do not have to be transported, and indoor smoke and fire hazards from kerosene lanterns are reduced (Obeng et al., 2008). Furthermore solar PV electrification contributes to improve quality of life in off-grid rural communities through the direct effect of the technology on household well-being and enterprise income (Cabraal et al, 2010; Fishbein et al., 2003; Martinot et. al., 2001; Posorski, 1996).

Cabraal et al. (1996) also report that in Sri Lanka and Indonesia, recurrent costs on kerosene, candles and batteries could reach \$10-\$30 per month. With the use of kerosene and dry-cells, it is observed that monthly expenses can be as costly as US\$ 10 per family (Lorenzo, 1997). These are relatively high expenditures. Though the use of solar PV may reduce the recurrent costs associated with the use of kerosene,

candles, and batteries, the amount of the reduction is uncertain and therefore deserves research attention.

Martinot et al. (2001) explored that, user satisfaction is considered one of the key elements for establishing rural PV markets as it is a comprehensive indicator of the perceived benefits of equipment quality and usage, and of the benefits of electricity supply on quality of life.

Wamukonya and Davis (2001) also found in their study that, satisfied households may also encourage others to acquire SHS, as has occurred in Namibia.

Gustavsson and Ellegård (2004) found that in Zambia, solar home system can bring benefits to the user, but it will also put up some new demands such as the lower monthly service fee. In terms of benefits, these will stem from the improved lighting conditions and from the access to 12V DC electricity. The improved light opens the possibilities to read and working hours. Children are reported to be the main beneficiaries. Radio, cassette recorders, followed by television sets are the most common appliances used by the users. They feel that their lives become more urban and modern. One third has problems with their system. Customers are found happy with the performance of the local supplier companies as ESCOs. Though the solar power has a positive impact but it has not been accessible for the low-income people.

According to Diessen (2008), Cambodia is struggling with its violent past and has one of the lowest electrification rates in Asia, with only 12 percent of its population of 13 million connected to a power supply. In addition, the costs of the available electricity rank as one of the highest in the world due to corruption and lack of alternatives. Extension of grid electricity lines is expensive and time consuming. Cambodia has a largely rural population, distances are long, population density small and the average power consumption low. Therefore about 90% of the rural population in Cambodia

has found an alternative in using wet-lead car batteries for their electricity supply. This however has major drawbacks on a social, economical and environmental level. Now, with oil prices rising and the economy improving people are in need of better power solutions, a solar home system could fulfill this need. SHS's have proven their ability to supply modern sustainable energy to rural areas of the developing world. Apart from its ecological advantages, it is also in many cases the most economic way to electrify rural areas and thereby improve the quality of life. There are however still many improvements to be made in the general design of the SHS, as there is a large failure of systems over time, many installation and maintenance problems, a high price and unreliable load conditions.

Obeng et al. (2008) illustrated in their study that, the intersectoral linkages of solar PV electrification and indicators on education, health, information acquisition, agriculture and micro-enterprises. They illustrated multi-sectoral linkages of solar PV influence on quality of life in off-grid rural communities. It indicates as well some social and economic benefits that may accrue to rural beneficiaries focusing on education, health, information, agriculture and micro-enterprise. It also reviews sustainability related issues including costs and market barriers, subsidies, stakeholders' involvement, political and policy implications, which are critical factors for sustainable market development of solar PV and other renewable

It is improbable that the grid can be extended to provide the majority of households with electricity in the foreseeable future (Karekezi and Kimani, 2002). With a low rural electrification rate of 1%, combined with a high cost of fuel-based off-grid electrification, potential for renewable energy technology (RET)-based electrification is especially high in Tanzania (Ahlborg and Hammar, 2014; Kassenga, 2008).

Tanzania obtains high-intensity sun radiation throughout the year because of its



geographical position (Kassenga, 2008; Ondraczek, 2013). Though solar PV market growth has been accelerating since the early 2000s but still the commercial market for solar PV is small and mostly concentrated in economically stronger areas like Dar es Salaam and Arusha. In 2008, non-governmental organizations (NGOs) and donors were the largest drivers of solar PV implementation (Kassenga, 2008). He argues that as wood fuel is usually not bought and budgeted for; solar energy would most likely replace kerosene for lighting rather than wood fuel for cooking. Solar PV especially, is a promising technology as capacity is not meant to replace existing commercial electricity, so it may not suffer from the lock-in effects of commercial energy that developed countries do encounter (Bosetti et al., 2012). In fact, several experts solicited in a study by Bosetti et al. (2012) see high probability for solar power to take up 21-30% of the energy mix in developing countries by 2050.

Ismail et al. (2012) identified that, Solar Photovoltaic (PV) can be considered as one of the most reliable and promising renewable systems in Nigeria especially in the rural communities where there is little or no access to electricity. The use of solar energy will no doubt contribute to the improvement of the living conditions of these villagers. They found that just 14.52% of the 4.5 kW installed solar PV was utilized due to significant malfunctioning and deterioration in performance. So the installed solar PV systems was inefficient as a result of poor maintenance, lack of technical know-how and inability of the project contractors or managers to take these factors into consideration while embarking on the solar PV installations.

According to Jahan et al. (2013) the global photovoltaic market has grown significantly over the last five years. Photovoltaic production has been increasing by an average of more than 20% each year since 2002, making it a fast-growing energy technology. At the end of 2011 the photovoltaic (PV) capacity world-wide was 67.4

GW. Top capacity countries were, in GW: Germany 24.7, Italy 12.5, Japan 4.7, Spain 4.2, the USA 4.2, and China 2.9. Many solar photo-voltaic power stations have been built, mainly in Europe. As of December 2011, the largest photovoltaic (PV) power plants in the world are the Golmud Solar Park (China, 200 MW), Sarnia Photovoltaic Power Plant (Canada, 97 MW), Montalto di Castro Photovoltaic Power Station (Italy, 84.2 MW), Finsterwalde Solar Park (Germany, 80.7 MW), Okhotnykovo Solar Park (Ukraine, 80 MW), Lieberose Photovoltaic Park (Germany, 71.8 MW), Rovigo Photovoltaic Power Plant (Italy, 70 MW), Olmedilla Photovoltaic Park (Spain, 60 MW), and the Strasskirchen Solar Park (Germany, 54 MW). There are also many large plants under construction. The Desert Sunlight Solar Farm is a 550 MW, Topaz Solar Farm is a 550 MW, Blythe Solar Power Project is a 500 MW, Agua Caliente Solar Project is a 290 MW, California Valley Solar Ranch (CVSR) is a 250 MW, and Antelope Valley Solar Ranch is a 230 MW are being built in United States of America (<http://www.ebiozone.com/current-status-of-renewable-energy-across-the-globe-bangladesh/>, 2013).

In summary, a very few studies on Solar Home System service in the international literature have been found to analyze the quality dimensions and customer satisfaction of the service.

## **2.10 Review of literature on Solar Home System Service in Bangladesh**

Actually very few papers dealt with the Solar Home Systems in Bangladesh. One study by Khan and Huque (1998a) indicated a significant market for Solar Home systems exist in Bangladesh. They observed a market size of approximately 0.5 million households is envisioned for solar electrification, which has the potential of extending to 4 million in the future. They identified that solar battery charging stations are not a suitable option for electrification in Bangladesh and should therefore be avoided in future implementation of solar PV programs. They showed that the rural households typically did not have sufficient income for direct cash purchase of a solar home system. So the use of credit or other forms of extended payment can expand the potential market significantly. The owners of shops in rural markets have significant interest in using small solar systems (SHSS) for lighting, in order to facilitate their business operations. The authors recommended the following important issues:

- National and regional plan for implementation of large scale program for SHS in rural electrification should be developed using predetermined criteria for qualification of solar PV programs. This plan should be consulted in association with the conventional master plan in place with Rural Electrification Board (REB) of Government of Bangladesh (GOB) for expansion of rural electrification, considering 61% of the respondents have opted for service from the existing Palli Bidyut Samiti(s).
- Appropriate measures should be taken for local certification and quality control of hardware.

-Use of trained distributors and maintenance contractors are recommended for sustainability of the systems.

-Large scale demonstration of SHS in different geographic regions should be initiated to create awareness for SHS.

-Considering the results obtained on willingness to pay for different levels of service, and the variation of income and assets of the potential users, it is recommended that the SHS be sized according to the desire of the users, i.e., options for service levels should be made available.

-Quality of service must be ensured from the beginning of any future SHS program through standardized systems and effective implementation of regulatory rules.

Users of Solar Home systems have expressed that they expect high standard of service (Khan 1998b). The need to provide high quality of service is, thus, a major requirement that must be ensured to the adopters. Price is key variable along with convenience of use, safety and the availability of support services to make the SHS and alternative to the traditional sources of rural energy. According to them a widespread adoption of the SHS is to be achieved for a high level of customer satisfaction.

Most of the experts involved in the Bangladeshi SHS dissemination process emphasized the potential of SHSs for income-generating activities. So the use of SHSs in small businesses and shops and therewith-connected longer opening hours and increased income were frequently mentioned. Campen et al. (2000) stated the additional time gained daily from the use of SHSs as an easily quantifiable impact indicator that could be linked with a potential impact in income generating activities.

The benefits of TV for adult education and training programs are also pointed out.

Blunck (2007), Komatsu et al. (2011), Samad et al. (1013), Asaduzzaman et al. (2013)

and Khan and Azad (2014) found that the benefits mentioned by the households using solar home systems avail opportunities of information and entertainment, improved lighting conditions, easier movement in the house at night, improved conditions for studying by school children, reduction of kerosene-related hassles, possibility to charge mobile phones, increased living standard, increased security and facilities of household work in the evening. They observed that although the number of overall income-generating activities was quite low, enterprises using a SHS confirmed customer's attraction and therewith-higher income earning. SHS's contribute to sustainable development mainly through the improvement of social aspects in rural life. The implementation of SHS's in rural Bangladesh, causes optimistic impacts, particularly in the areas of education, health, information, communication, social security and household works. Moreover, the plummeting of CO<sub>2</sub> emissions through the substitution of traditional lighting fuels has to be mentioned as a positive environmental impact. The economic impacts of the SHS's are limited to an increase in income of shops. So the SHS becomes a financially viable investment (Asaduzzaman et al., 2013; Blunck, 2007).

According to Komatsu et al. (2011) SHS becomes a popular electrification tool in rural areas and several indicators have been used as evaluation tools for off-grid household electrification with SHS, such as number of SHS installed, percentage of installed SHS currently operating, technological transfer to the enterprises involved, and the creation of markets for SHS and their accessories. Moreover, user satisfaction is widely applied as an evaluation tool for those who have received electricity from SHS.

As low user satisfaction may discourage citizens from continuously paying their electricity bills, and it also discourages other residents who have not adopted SHS

from purchasing the equipment. Therefore maintaining high satisfaction levels is essential for ensuring long-term sustainability of the initiatives (Komatsu et al., 2011). He also stated that, as the respondents with larger SHS have higher financial costs and possibly greater expectations for their SHS, they may feel satisfied with their SHS if their SHS experiences exceed the prior expectations. The main determinants of user satisfaction found by him are equipment quality, energy saving, and the perceived improvement in lifestyle of households with SHS. Both the quality of SHS equipment and other factors, such as how SHS have improved user lifestyles, are possible determinants of satisfaction because households' experiences with SHS may influence their perceived satisfaction.

According to Siegel and Rahman (2011) Barriers to SHS diffusion according to owners and non owners are: SHS cost is too high, spare parts are not available, down payment and monthly installment are too high, load capacity is limited, cannot run TV/ fan/ refrigerator, running time is too low, lack of publicity and after sales service is not available.

According to Samad et al. (2013), households with better physical and educational endowments are more likely to adopt solar home systems than poor households. And it is found to increase household consumption expenditure, although at a small scale.

But reference to service quality dimensions and customer satisfaction of Solar Home System service in Bangladesh is scarce in literature. In one study on "Case Study Applications of Solar PV on Rural Development in Bangladesh" Ahammed and Taufiq (2008), discussed that the factors contributing to the successful promotion of solar PV based rural electrification are (a) suitable finance schemes to address the problem of high initial cost, (b) adequate means of providing regular and proper

maintenance and supplying spare parts, and (c) viable choice of available configurations to suit the consumers' needs and affordability.

Aziz et al. (2009) found that the customers are largely satisfied with the availability and quality of the financing and sales services of the partner organizations. The study has measured the satisfaction level of the consumers in eight areas of the SHS service namely number of appliances supported, stability of electricity, quality of electricity, frequency of breakdowns, helpful information from the company, financing facilities of the company, troubleshooting services. The responses indicate that most of the consumers are either satisfied or highly satisfied with the SHS they use in their homes or rural small businesses.

Momotaz (2010) also investigated the market potentiality of Solar Photovoltaic System in Bangladesh in her M Phil thesis. The study indicates that a significant market for SHSs exist in Bangladesh. Majority of the household people and retailers use the SHS with capacity of 50 watt through which they can run 4 lights (6 Watt), 1 Black & White TV point and 1 mobile charger for 4-5 hours. Most of the respondents are found happy to get more benefits than the cost of buying a SHS like having brighter light, safe environment etc. Moreover, majority of them agreed that the cost of buying a SHS is within their purchasing ability and they showed a strong preference for obtaining SHSs on credit payment. They have given the highest importance on good quality of the SHS which is followed by reasonable price, capacity, availability of the providers, availability of loan from them, longevity of the system, maintenance cost, sustainability & reasonable monthly installment cost of the SHS. Most of the respondents strongly agreed with the contribution of the SHSs to students through getting more time to study at night followed by the availability of the option of mobile charging, option of entertainment in their houses like playing TV,

DVD, availability of the bright light in the house, efficient use of the time at night and doing more household works at night, reduced labor for lightening the house and healthy environment in the house as there is emission of gas, dust etc, from the SHS. But the retailers have given the highest importance on the availability of loan from the system providers that is followed by the good quality of the system, convenient use of the system, credibility of the providers, enough capacity of the system, reasonable price, the Leaflet, catalog provided, reasonable monthly installment cost, sustainability and regular warranty support of the system.

Asaduzzaman et al. (2013) argued that variables such as total annual income, education of head of the household, non-agricultural occupation, women's education and whether the household has a woman as its head do positively and statistically significantly influence the choice of installation of a SHS.

According to Khan and Azad (2014) the implementation of SHS's in rural Bangladesh, causes optimistic impacts, particularly in the areas of education, health, information, communication, social security and household works. Moreover, the plummeting of CO<sub>2</sub> emissions through the substitution of traditional lighting fuels has to be mentioned as a positive environmental impact. The economic impacts of the SHS's are limited to an increase in income of shops. Though overall users of SHS are satisfied with the service they are getting but the main problem of dissatisfaction with SHS is related to low frequency of response; irregular technical service, shortage of manpower.

In summary, SHS installation in Bangladesh usually gives favorable outcomes for standards of living of rural households, although the determinants of satisfaction have not yet been evaluated. Most of these studies did not cover service quality dimensions and customer satisfaction. To the best of the authors' knowledge, no previous



empirical studies were undertaken on measuring service quality dimension, perceived value and customer satisfaction of SHS service in Bangladesh.

## **2.11 Conclusion**

A number of conclusions can be drawn from the above discussion with regards to customer satisfaction and its predictor variables specific to Solar home System Service of Bangladesh.

First, some basic theories provide momentum to a number of service quality dimensions. But no studies have been done for examining the service quality dimensions of SHS service in Bangladesh. So the present study will make an effort to assess the quality dimensions of the SHS service in the country.

Second, the literature reveals that perceived value research is undertaken mostly on goods, while less so on services, particularly on services related to Solar Home System. Further, most research projects are implemented in developed countries. Especially with regard to SHS services in Bangladesh, no research was undertaken where perceived value was taken as a critical component of overall SHS customers' perceived service. So the researcher has tried to identify the effect of service quality dimensions on perceived value of SHS service in Bangladesh.

Third, no studies are found on measuring the mediating effect of perceived value in the relationship between service quality dimensions and customer satisfaction of the Solar Home System Service in Bangladesh. Hence, it motivates the researchers to measure the mediating effect of perceived value in the relationship between service quality dimensions and customer satisfaction of Solar home System Service in Bangladesh.

Fourth, despite the term “customer satisfaction” drawing attention in several areas of research but it is not examined with empirical data in Solar Home System Service industry in Bangladesh. Keeping all these considerations in mind, the researcher has undertaken the issue as a research agenda, with a view to fulfill the vacuum that now exists in the industry of Solar Home Systems in Bangladesh. The present study has made an effort to assess the service quality dimensions and customer satisfaction of the Solar Home Systems service in some selected areas of Dhaka Division Bangladesh.

Accordingly, the next section of this study proposes a comprehensive research framework incorporating the identified independent variables and dependent variables and mediating variables along with hypothesized relationship.

# **CHAPTER THREE**

## **CONCEPTUAL FRAMEWORK**

### **3.1 Introduction**

In this chapter, the concepts of service, service quality dimension and perceived value and relevant theoretical tools for analyzing the relationship between quality dimensions and perceived value; relationship between perceived value and customer satisfaction and the mediating role of perceived value on service quality dimensions and customer satisfaction are discussed based on the available literature in the international and local (Bangladesh) contexts. The relevant theoretical literature was discussed for conceptual insight to explore the influence of quality dimensions to customer satisfaction; quality dimensions to perceived value; of perceived value to customer satisfaction and mediating effects of perceived value to service quality dimension and customer satisfaction of SHS service in Bangladesh. This will provide a deeper understanding of the determinants of customer satisfaction within the SHS industry. To achieve this goal, this chapter proposes a competing model to verify the influence of quality dimensions to customer satisfaction; quality dimensions to perceived value; perceived value to customer satisfaction and mediating effects of perceived value to service quality dimension and customer satisfaction of SHS service in Bangladesh with hypothesized relationships. This proposed model that is to be analyzed and hypotheses to be tested in next chapter.

The current chapter comprises six sections. Following the introduction, the analytical framework is presented in the second section. The influence of quality dimensions to customer satisfaction are described in the third section, quality dimensions to perceived value are presented in the fourth section, influence of perceived value to customer satisfaction in fifth section and mediating effects of perceived value to

service quality dimension and customer satisfaction. The sixth and final section concludes and summarizes the key points.

### **3.2 The Proposed Theoretical Model and Hypothesized Relationships**

As discussed in chapter one and in chapter two, this thesis is concerned with identifying the quality dimensions and customer satisfaction of Solar Home System Service in Bangladesh focusing on mediating effects of perceived value to service quality dimension and customer satisfaction of the service. Based on the three research questions mentioned in chapter one namely, (1) what variables determine the service quality dimensions of the Solar Home Systems service in Bangladesh?; (2) how does service quality influence perceived value of the Solar Home Systems service in Bangladesh?; (3) how does service quality influence customer satisfaction of the Solar Home Systems service in Bangladesh? And (4) how does perceived value mediate service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh? An analytical framework has been developed from the international and local (Bangladesh) literature on relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction adopted from Agus et al. (2007), Caruana (2002) and Ismail et al. (2009) and illustrated in Figure 3.1. But in Bangladesh no previous empirical studies is undertaken on measuring relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value

and mediating effects of perceived value on service quality and customer satisfaction of the service.

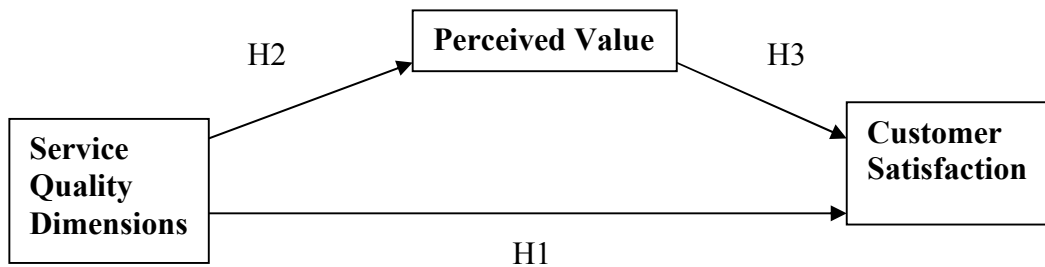


Figure 3.1: Conceptual Model of the Research (adopted from Agus et al., 2007, Caruana, 2002 and Ismail et al., 2009)

This conceptual research framework assesses the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. The theoretical model guiding the investigation is adapted from Agus et al. (2007), Caruana (2002) and Ismail et al. (2009). The model includes four main hypotheses, which were tested. Hypothesis (H1) reflects the influence of service quality dimensions on customer satisfaction. Hypothesis (H2) reflects the influence of service quality dimensions on perceived value. Hypothesis (H3) reflects the influence of perceived value on customer satisfaction. Hypothesis (H4) reflects the mediating effects of perceived value to service quality dimension and customer satisfaction. Here the service quality dimensions have been treated as the independent variables and the customer satisfaction as the dependent variable. Here the perceived value acts as the mediating variable between service quality dimensions and customer satisfaction. The hypotheses for the relationships in the model have been proposed in the sections to follow:

### **3.3 Influence of Service Quality Dimensions on Customer Satisfaction**

The relationship among service quality and customer satisfaction has received considerable attention in the marketing literature (Cronin and Taylor, 1992; Zeithaml et al., 1996; Meuter et al., 2000; Brady et al., 2001 and Olorunniwo et al., 2006). Some authors have agreed to the fact that service quality determines customer satisfaction. Parasuraman et al. (1985) in their study proposed that when perceived service quality is high, then it will lead to increase in customer satisfaction. Researchers have investigated that service quality affects to satisfaction (Bitner, 1990). Cronin and Taylor (1992) identified that service quality is a determinant of customer satisfaction. Most of the researchers found that Service quality is an antecedent of the broader concept of customer satisfaction (Oliver, 1993; Gotlieb et al., 1994; Zeithaml and Bitner, 1996; Lee et al., 2000; Bedi, 2010; Kassim and Abdullah, 2003; Kumar et al., 2010; Naeem and Saif, 2009; Balaji, 2009; Lee and Hwan, 2005; Athanassopoulos and Iliakopoulos, 2003 and Culiberg and Rojšek, 2010). González and Brea (2005) and Ekinici (2004) using recursive structural models provided empirical support that service quality results in customer satisfaction. Some researchers reported the positive relationship between customer satisfaction and service quality (Gilbert et al., 2004; Gilbert and Veloutsou, 2006; Agus et al., 2007; Jamali, 2007; Ku et al., 2008, Zaim et al., 2010; Mengi, 2009; Kumar et al., 2010; and Lai, 2004; Yee et al., 2010 and Siddiqi, 2010).

This implies that service quality has a positive influence on customer satisfaction. This research studied total seven factors of service quality, out of them five are adopted from SERVQUAL Model by Parasuraman et al. (1985) namely: reliability,

responsiveness, assurance, empathy, tangibility and two from Grönroos model (1982, 1990) namely: technology and image of Partner Organization. Therefore, based on the arguments supporting the positive impact of service quality dimensions (reliability, responsiveness, assurance, empathy, tangibles, technology and image of PO) on customer satisfaction it is hypothesised that:

H1: There is a positive relationship between service quality dimensions and customer satisfaction of SHS service in Bangladesh.

### **3.4 Influence of Service Quality Dimensions on Perceived Value**

Several scholars examined association between service quality and perceived value in their studies (Hutchinson et al., 2009; Lai et al., 2009; Wu and Liang, 2009). They found high service quality is correlated with high perceived value.

Gallarza and Saura (2006) explored that higher perceived quality typically leads to higher perceived value (e.g., Sweeney et al., 1999; Teas and Agarwal, 2000, Cronin et al., 2000; Petrick, 2002, 2004; Wu and Liang, 2009 and Chen and Chen, 2010).

Turel and Serenko (2006) and Lai et al. (2009) studied relationship between service quality and perceived value along with other constructs in mobile phone service industry and found service quality positively motivate perceived value. Service quality is also found as an antecedent of value perceptions by Hutchinson et al. (2009).

So the reviewed literature showed that a generally positive relationship exists between service quality dimension and perceived value. Therefore, based on the arguments supporting the positive impact of service quality dimensions (reliability,



responsiveness, assurance, empathy, tangibles, technology and image of PO) on perceived value it is hypothesised that:

H2: There is a positive relationship between service quality dimensions and perceived value of SHS service in Bangladesh.

### **3.5 Influence of Perceived value on Customer Satisfaction**

Perceived value acts as an important tool in customer satisfaction based on different studies. Though it is a very important concept, only few researches have investigated the antecedents and the consequences of perceived service value in detail (Ladhari and Morales, 2008). There is empirical evidence that customer perceived-value has a positive effect on customer satisfaction (Anderson & Mittal, 2000 and Walter et al., 2002; Iglesias & Guillen, 2004; Lin and Wang, 2006; Lai et al., 2009; Raza et al., 2012). Takala et al. (2006) explained that perceived value both directly and indirectly influences customer satisfaction. Petrick (2004) emphasized that perceived value is important factor related with customer satisfaction and repurchase intention. Frank and Enkawa (2007) also found the relationship between perceived value and customer satisfaction. The extent of satisfaction depends on extent of perceived value and higher level of perceived value lead to higher level of customer satisfaction (Turel and Serenko, 2006). Therefore, the following hypothesis is proposed.

H3: There is a positive relationship between perceived value and customer satisfaction of SHS service in Bangladesh.

### **3.6 Mediating Role of Perceived Value to Service Quality Dimensions and Customer Satisfaction**

Among the determinants of satisfaction perceived value is the important one (Chen and Chen, 2010). Even though many studies have been done, little is known about the mediating effect of perceived value in service quality models (Caruana et al., 2000; Eggert and Ulaga, 2002). A thorough review of relationship between service quality and customer satisfaction reveals that service quality characteristics on customer satisfaction is indirectly affected by perceived value (Caruana et al., 2000; Varki & Colgate, 2001; Eggert and Ulaga, 2002). Caruana et al. (2000) has a research model to identify and explore to determine whether perceived value plays a moderating role between service quality and satisfaction among customers of an audit firm. Sureshchandar, (2000) and Sureshchandar et al. (2002) stated that in a service management context, the ability of an organization to use reliability, responsiveness, assurance and empathy in delivering services will increase customers' perceptions of value; this may lead to higher customer satisfaction. Again, perceived value plays mediating role between service or product quality and customer satisfaction (Chen and Tsai, 2008). Ismail et al. (2009) studied the relationship between service quality, perceived value and satisfaction where they found perceived value as a partial moderating variable between service quality dimensions and satisfaction. Yunus et al. (2009) and Jhandir (2012) found that perceived value acts as a partial mediating variable in the relationship between service quality characteristics and customer satisfaction. Uddin and Akhter (2012) also found perceived value has mediating role between service quality, price fairness and customer satisfaction.

Therefore, the following hypothesis is suggested:

H4: Perceive value mediates the service quality dimensions on customer satisfaction of SHS service in Bangladesh.

### **3.7 Conclusion**

The objective of this study is to examine the proposed model to verify the influence of quality dimensions to customer satisfaction; quality dimensions to perceived value; perceived value to customer satisfaction and mediating effects of perceived value to service quality dimension and customer satisfaction of SHS service in Bangladesh. This will provide a deeper understanding of the determinants of customer satisfaction within the SHS industry. To achieve this goal, this chapter proposes a model to verify the influence of quality dimensions to customer satisfaction; quality dimensions to perceived value; perceived value to customer satisfaction and mediating effects of perceived value to service quality dimension and customer satisfaction of SHS service in Bangladesh with hypothesized relationships. Hence, four hypotheses (H1, H2, H3 and H4) have been formulated to reflect the casual relationships between these underlying constructs, in which the service quality dimensions have been treated as the independent variables and the customer satisfaction as the dependent variable. Here the perceived value acts as the mediating variable between service quality dimensions and customer satisfaction. The proposed conceptual model is tested in chapter 5 using empirical information gathered for this study.

# **CHAPTER FOUR**

## **RESEARCH METHODOLOGY**

## **4.1 Introduction**

This chapter provides justifications of the methodology used in the study. The methods were selected based on the proposed conceptual model (figure 3.1) to investigate the theoretical relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh drawn from the literature and test this through hypothesis. This chapter covers all the quantitative and qualitative research approaches to be followed in this study. Research designs, data collection strategy, sampling design, measurement of constructs and data preparation of the study are the topics covered here. Therefore, the goals of this chapter are to:

- To justify the research design of the study focusing on quantitative research technique of the study.
- To illustrate the data collection strategy of the study with the sources of Primary data collection as well as secondary data collection.
- To explore the sampling design focusing on identifying target population, sampling frame, sampling technique and sample size determination.
- To clarify the measurement of constructs in this thesis by selecting scale items.
- To portray the data preparation of the study with checking all questions for completeness followed by editing, coding, and transcribing the data.

## **4.2 Research Design**

According to Malhotra and Dash (2011) descriptive research is the type of conclusive research that has as its major objectives the description of something- usually market characteristics or functions. This type of research is characterized by the prior formulation of specific hypotheses. Thus the information needed is clearly defined. It is preplanned and structured. It is typically based on large representative samples. In this sense, the study is descriptive in nature. Descriptive research in the form of a survey is undertaken to quantify the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. This study used a Cross-sectional research design which is the most frequently used descriptive design in marketing research. The study followed the Single Cross-sectional design where only one sample of respondents is drawn from the target population and information is obtained from this sample only once. This is also known as sample survey research designs.

To gain an understanding of the research problem and its underlying factors a qualitative research technique was undertaken first. In-depth interviews were conducted involving two industry experts like two Area Managers of Grameen Shakti (one of the Partner Organization of IDCOL) and six users of SHS. They are selected based on purposive sampling where the interviewees have good knowledge and experiences with SHS use in rural areas of Bangladesh. Information gathered from them helped the researcher to understand the nature of quality service policies and

procedure, perceptions of value about service quality and customer satisfaction characteristics. After refining, categorizing and comparing the information with relevant theoretical and empirical evidence, this was used as a guideline to develop the content of survey questionnaires for pilot survey.

The research questions of the present study required that quantitative approach for data collection and analysis be employed. As the objective of this thesis is to empirically investigate casual relationships between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh quantitative approaches is required.

A survey method was found to be the most appropriate tool to collect Primary data. Survey is a research technique in which information is gathered from a sample of people by use of a questionnaire or interview; a method of data collection based on communication with a representative sample of individuals (Zikmund, 2003). But the problems associated with survey methods are lack of control over timeliness, difficulty in determining whether the selected respondents are being truthful, and lack of detail and depth of information (Hair et al., 2003). To avoid those problems associated with survey methods the guidelines recommended by Hair et al. (2003) were taken into account to ensure precision. First, when possible previously tested reliable and valid scales were used to measure the underlying constructs. Second, the questionnaire was designed in a way that was easy for the respondents to understand and was free of response bias.

This study used “Personal In- home interviews of survey method” to collect the necessary data where respondents are interviewed face to face in their homes. According

to Malhotra and Dash (2011), in Personal In-home interviews, respondents are interviewed face-to-face in their homes. The interviewer's task is to contact the respondents, ask the questions, and record the response. Some advantages of using this method are: (1) respondents respond highly because here less effort is required to answer the questions at home and the interviewer explain and clarify difficult questions, (2) large amounts of data can be collected because the social relationship between the interviewer and the respondent, as well as the home environment, motivate respondents to spend more time in the interview and a wide variety of questions can be asked, (3) it is possible to control which sampling units are interviewed, who is interviewed, the degree of participation of other members of the household etc., and (4) low incident rate. But this method is highly susceptible to interviewer bias given the face-to-face interaction between the interviewer and the respondent. The speed of data collection is moderate and cost is high also. As the market for SHS is expanded in the rural areas of Bangladesh where the literacy rate is lower than urban area, so respondents needed the presence of interviewer guidance to explain and clarify difficult questions. Moreover, face-to-face interaction between the interviewer and the respondent make the method highly desirable in social aspect.

### **4.3 Data Collection Strategy**

The sources of data are broadly classified in to two categories like primary and secondary data. To satisfy the research questions, both primary and secondary data sources were used as bases for data collection. A “multi method” approach to data collection was applied to collect relevant data, including a questionnaire survey, interviews, and documentary sources.



### **4.3.1 Primary Data Collection**

The purpose of the primary data collection was to supplement the secondary data. For this research, a survey method is conducted to collect Primary data. Primary data were collected by surveying the end-users through a structured questionnaire. The questionnaire design was conducted through a series of steps recommended by Malhotra and Dash (2011).

#### **Questionnaire Design**

Efforts were made to find out the service quality and the Customer Satisfaction of the Solar Home System service in Bangladesh. The findings of the questionnaire survey helped in further explaining the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. End-users of Solar Home System in Bangladesh like the household users and retailers were the target population and a survey method was found to be the most appropriate tool to collect Primary data. Actions were taken to overcome the inability to answer and unwillingness to answer. The questions were structured which specified the set response alternatives and response format (Malhotra and Dash, 2011). The questionnaire was designed with close-ended questions. Among the types of structured questions multiple-choice questions and scale were used. The questions wording were clear and easily understandable by the respondents. Ordinary and unambiguous words were used whereas leading or biasing questions, implicit alternative, implicit assumptions, generalization and dual statements were avoided. The content of the questionnaire

was then translated into Bangla in order to increase the validity and reliability of the instrument.

As the opening question are crucial in gaining the confidence and cooperation of respondents so questions asking respondents about the use of SHS was used as opening question in the questionnaire. As a general guideline, basic information that relates directly to the research problem was obtained first, followed by classification information consisting of socioeconomic and demographic characteristics of respondents and, finally identification information such name, address, etc of respondents. The questionnaire was designed in a logical order. The questionnaire was divided into five parts.

To identify and eliminate potential problems pre-testing of the questionnaire was done by the author. At first the draft questionnaire was distributed to a panel of two experts, one was professor in the area of Marketing at Dhaka University and another was a Unit Manager of “Grameen Shakti”. They were asked to evaluate the questionnaire and make further suggestions, criticism and comments on the questionnaire and its impacts on respondents. Changes were required for general questions regarding the use of the SHS like major appliances used by the SHS, occupation of respondents; educational status of the respondents and the image of PO. Several new questions like: most benefitted members by the SHS, handling the damaged battery and number of family members in the household were added also. Then personal interviews with 15 respondents were conducted to observe respondent’ reactions and attitudes and ask them to identify any problems regarding the questionnaire format, wording and to address any comments or suggestions they had. The respondents in the pretest were similar to those were included in the actual survey in terms of background characteristics, familiarity with topic, and attitudes and behaviors of interest. Two

items of Image of PO and one item of Perceived Value were deducted as found not important to the users and three items were added to Technology as found important to buy a system. The questionnaire was then corrected for the problems identified during pretesting. Then the responses obtained from the pretest were coded and analyzed. In this way the final questionnaire was designed for this thesis. The questionnaire was divided into five parts. A copy of the questionnaire is attached in Appendix II and Appendix III . The questionnaire was structured in following five parts:

Part 1:

The first part includes general questions regarding the use of the SHS, technical data about the system, mode of purchase, duration of use, frequency of malfunction, management of damaged battery and benefitted family members of using the system. This section includes 14 questions.

Part 2:

The second part of the questionnaire includes questions asking respondents to evaluate the service quality dimensions of the SHS service of Reliability, Responsiveness, Assurance, Empathy, Tangibility, Assurance, Empathy, technical and Image of PO. This section includes 39 questions.

Part 3:

The third part includes ten questions asking respondents about to evaluate the perceived value of the SHS service.

Part 4:

The fourth part includes five questions asking respondents to describe how satisfied they are regarding the SHS service.

Part 5:

The fifth part of the questionnaire contained ten questions asking respondents about different demographic and socio-economic information like their age, religion, marital status, education, occupation, monthly income, number of family members in the household or retail shop and address.

The second, third and fourth parts of the questionnaire reflected the underlying constructs. These constructs were presented in this instrument using five-point Likert scale, ranging from 1= strongly disagree to 5=strongly agree. All the questions in this questionnaire were presented within six pages which were within the recommended length of questionnaire of six by Zikmund (2003).

The findings of the questionnaire survey helped in further explaining the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh.

#### **4.3.2 Secondary Data Collection**

Secondary data were collected from different books, reports, newsletters, leaflets, design manuals, articles, periodicals, annual reports, official records, brochure, Government report, newspapers, text books, journals, magazines, websites etc. for a better understanding of the research problems, questions and to explore literature. Secondary data were collected from following sources for different purposes of the research:

1. Defining the research problem was one of the most important endeavors of the present study. This process began by analyzing the data on SHS service in Bangladesh. The main sources of data on the service were the different annual reports and other documents from the relevant government agencies in Bangladesh like Rural Electrification Board (REB), Polli Bidyut Samity (PBS), Infrastructural Development Company Limited (IDCOL) and Bangladesh Bureau of Statistics (BBS) as well as other related research articles and newspaper articles published locally.
2. The Statistical Pocketbook 2013, BBS, Bangladesh were used to discuss the economic and demographic data of Bangladesh and as well as socio-economic data of SHS users also.
3. Assessing the effectiveness of the planning tools being used in Energy sector of Bangladesh was important. A detailed study on different types of Government reports like the Annual report 2014-2015, Bangladesh power Development Board Dhaka gave a firm concept on government planning intentions.
4. Annual report, official records, websites, newsletter, brochure, design manual etc. of IDCOL and its different POs were studied to discuss an overview of the SHS industry.
5. Different Text Books on Marketing Research and Services Marketing as well as different articles on service quality, perceived value, and customer satisfaction found both in local and international journals were studied to define the research objectives, design theoretical Model with hypotheses, develop research questions and specify information needed.

The sources of secondary data are listed in Reference section.

Moreover, the desk study also covered various published and unpublished materials on the subject.

## **4.4 Sampling Design**

### **4.4.1. Target Population**

End-users of Solar Home System in Bangladesh like the household users and retailers are the target population because they are homogeneous in their use of SHS but heterogeneous in other aspects (age, income, profession, etc.). Their opinions are mainly sought because they are the best able to evaluate existing service quality and satisfaction with such services.

Here the sample elements are End-users of Solar Home System in Bangladesh and the Sampling Units are the users of the SHS in Bangladesh.

### **4.4.2 Sampling Frame**

A sampling frame can simply be defined as the set of source materials from which the sample is selected. The purpose of the sampling frame is also included in that definition, and it provides a means for choosing the members of a target population for a survey or interview. The target groups for the current study are SHS users. But defining the sample frame for the survey was particularly difficult because no data on SHS users over time in Bangladesh was readily available.

### **4.4.3 Sampling Technique**

A purposive sampling method was adopted to select the samples for the questionnaire survey, and the process is described in the following paragraphs.

Broadly, two major approaches are used for selecting a sample for the purpose of data collection, i.e., probability and non-probability sampling. Probability sampling is generally used in quantitative studies, and this type of sampling can be achieved

through the random selection of a sample among all the units of the population. On the other hand, non-probability sampling can be used in both quantitative and qualitative studies and may come in different forms, such as purposive sampling, quota sampling, convenience sampling and snowball sampling. Generally, non-probability sampling is used in qualitative research. However, the selection of a desirable sampling method depends on the nature of a research and the context in which the research is being conducted. The current research employed the 'purposive sampling method' because it aims at investigate the theoretical relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. Thus, purposively choosing the survey areas and the respondents was necessary to satisfy that specific purpose of the present work.

#### **4.4.4 Sample Size Determination**

Sample size refers to the number of elements to be included in the study (Malhotra and Dash, 2011). Determining the sample size is complex and involves several qualitative and quantitative considerations. Important qualitative factors that are considered are as follows:

(1) The importance of the decisions- As investigating the theoretical relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh are important decisions so larger samples are needed for study.

(2) The nature of the research- As the study is descriptive in nature, larger samples are required.

(3) The number of variables- As the data were collected on a large number of variables, larger samples was required.

(4) The nature of the analysis- As sophisticated analysis of data using multivariate techniques were required for the analysis, the sample size were large.

(5) Sample sizes used in similar studies- Sample size is influenced by the average size of samples in similar studies. Following table gives an idea of sample sizes used in different marketing research studies:

**Table 4.1: Sample sizes used in different marketing research studies (Malhotra and Dash, 2011)**

Type of study	Minimum Size	Typical Range
Problem Identification Research (e.g., market potential)	500	1,000-2,500
Problem Solving Research (e.g., pricing)	200	300-500
Product Test	200	300-500
Test-marketing Studies	200	300-500
TV/radio/print advertising (per commercial or ad tested)	150	200-300
Test-market audits	10 stores	10 -20 stores
Focus groups	2 groups	6-15 groups

Being a Problem Solving Research this study will need a range of sample size from 300-500.

(6) Resource constraints- Sample size decision should be guided by a consideration of the resource constraints. As both money and time of researcher was limited so a large number of samples were not selected for the study. Moreover, no data on SHS users



over time in Bangladesh was readily available.

Considering all of the above factors, SHS household users and retailers were identified based on a number of purposive criteria. Manikganj District of Dhaka Division and Nesarabad and Nazirpur districts of Barisal division were selected to collect information. Only two districts were selected purposively due to the fact that the suppliers of SHS industry are located there, limited resource and time constraint of the researcher to conduct the study in all over the Bangladesh and easy access for the researcher to collect data and information. Three upazilas, namely, Manikganj of Manikganj district and Nesarbad and Naziirpur of Pirojpur districts were selected for the survey of respondents. 14 villages of Singair and 9 villages of Ghior from Manikganj and 12 villages of Nesarabad and 5 villages of Najirpur from Barisal district have been selected for data collection. But there is no record exists to list the total number of people using SHS under these areas.

After selecting the area, the researcher talked to the Area Manager of a specific branch office of the PO and then he guided the researcher to visit the villages and identify respondents. In this way, about 350 respondents were surveyed but among them 314 questionnaires were usable for the analysis, yielding 89.71 % response rate. The questionnaire was answered by participants based on their consent. This sampling method was considered acceptable since the purpose of the questionnaire survey was to get perception from the respondents regarding the SHS service at house or retail shop. Table 4.2 shows the sample size for the questionnaire survey.

**Table 4.2: Sample Size of the Survey:**

<b>Division</b>	<b>District</b>	<b>Upazila</b>	<b>Village</b>	<b>Sample size</b>		
Dhaka	Manikganj	Singair	South Dholla	27		
			Dhollabazar	1		
			Binadingi Bazar	8		
			Sudkhira	6		
			Noyadingi	10		
			Fordnagor	32		
			Gajinda	5		
			West Dholla	10		
			Jaila	4		
			Paril	2		
			Chandanpur	1		
			Deuly	1		
			North Bakchar	2		
			Rafiqnagar	17		
			Total in Singair	126		
				Ghior	Ghior	27
			Jobra	12		
			Chakpara	1		
			Dimukha	1		
			Baliakhora	3		
			Rathura	5		
			Baniajuri	1		
			Bazarkhola	2		
			Durgabazar	2		
		Total in Ghior		54		
Barisal	Pirojpur	Nesarabad (Swarupkathi)	kharabag	49		
			Katapita	22		
			West Shohagdal	17		
			Rajabari	12		
			Shohagdal	3		
			Chami	1		
			Boroibari	2		
			Bashtola	1		
			Koiarkhara	2		
			Chiltola	3		
			Bhajjora	3		
			Indurhat	1		
			Total in Nesarabad	116		
					Najirpur	Kolaroania
					Soilabunia	1
			Uribunia	12		
			Chinabunia	3		
			Lebujurbunia	1		
		Total in Najirpur		18		
<b>Grand Total</b>				<b>314</b>		

## **4. 5 Measurement of Constructs**

This study carefully considered the research objectives with respect to measurement of dependent variable (DV) as Customer Satisfaction, independent variables (IV) as Service Quality Dimensions and mediating variable as Perceived Value. All of the DV, IVs and mediating variable were measured at the same time due to difficulties of getting longitudinal data in this research field. The reliability and validity of measures have been proposed to be assessed by the plan and procedures as suggested in the literature (Nunnally and Bersnstein, 1994). The validity measurement have been described and assessed in chapter seven to explore the “hypothesized relations between a scale of interest and other variable”.

This section explains the selection of scale items that are used to measure the constructs in this thesis. These are: Service Quality Dimensions, Perceived Value and Customer Satisfaction. A total of 54 scale items were used to measure the constructs in the model. Table 4.3 shows a summary of the items used to test each construct. These items are further discussed later in this section. Constructs have been operationalised using five-point Likert scale, ranging from 1= strongly disagree to 5=strongly agree. All the underlying constructs in the proposed model are presented, and items used to measure them are discussed.

**Table 4.3: Total Scale Items used in the Thesis**

Constructs	Number of Items	Adopted from
1. Service Quality Dimensions		
Reliability	6 items	Parasuraman et al. (1988, 1990); Khan (2003); Cook and Thompson (2000); Nitecki and Hernon (2000); Yunus et al. (2009); Ismail et al. (2009) and Jhandir (2012).
Responsiveness	5 items	
Assurance	6 items	
Empathy	7 items	
Tangibility	4 items	
Technology	8 items	Gronroos (1982, 1990); Lehtinen and Lehtinen (1982); Rust and Oliver (1994) and Brady and Robertson (2001)
2. Image of PO	3 items	Grönroos (1982, 1990); Lehtinen and Lehtinen (1982) and Brady and Robertson (2001).
3. Perceived Value	10 items	Zeithaml (1988); Sweeney & Soutar (2001); Petric (2002); Lim et al (2006); Lee et al. (2007); Tsai (2008); Yang and Peterson (2004); Yunus et al. (2009); Ismail et al. (2009); Jhandir (2012); Raza et al. (2012) and Rizwan (2014).
4. Customer Satisfaction	5 items	Parasuraman et al. (1988), Szymanski and Henard (2001) and Sureshchander et al. (2002)

#### 4.5.1 Service Quality Dimensions

Measuring service quality is a better way to dictate whether the services are good or bad and whether the customers will or are satisfied with it. As discussed in Chapter two, from the literature of service it is apparent that perceptions of service quality are based on multiple dimensions, there is no general agreement as to the nature or content of the dimensions. Because service quality has a distinct constructs and

distinguished features for different services. The seven main types- Reliability, Responsiveness, Assurance, Empathy, Tangibility, technology and Image of PO- that have been empirically tested used as the main focus in previous research (are incorporated in the proposed theoretical model of this thesis. Fivefold dimensions of reliability, responsiveness, assurance, empathy and tangibles were taken as constructs from SERVQUAL model (parasuraman et al., 1988) and two additional constructs named as technology and image of PO was adopted from Grönroos (1984) model. To measure service quality dimensions, the 39 items scale has been used in the analysis. Here, the author used five-point Likert scale, ranging from 1= strongly disagree to 5=strongly agree. This questionnaire consists of seven major sections:

#### **a. Reliability**

Reliability is defined as “the ability to perform the promised service dependably and accurately” or “delivering on its promises”. This dimension is critical as all SHS users want to deal with POs that keep their promises and this is generally communicated to the users. In this study the reliability was measured using six items. The items used to measure this variable were:

- (1) Providing service as promised,
- (2) Dependability in handing the service performed,
- (3) Performing the services right the first time and every time,
- (4) Providing services at the promised time,
- (5) Competency and making low mistakes and
- (6) Honesty of staffs.

## **b. Responsiveness**

The responsiveness refers to the willingness of the company to help its customers in providing them with a good, quality and fast service. It is defined as the willingness to help customers and provide prompt service”. In this study the responsiveness was measured using six items. The items used to measure this variable were:

- (1) Keeping users informed about when services will be performed,
- (2) Prompt service and keeping waiting time in a minimum,
- (3) Willing to help always,
- 4) Responsive to requests and
- (5) Offering personalized service.

## **c. Assurance**

Assurance is defined as “the employees’ knowledge and courtesy and the service provider’s ability to inspire trust and confidence”. In this study the assurance was measured using six items. The items used to measure assurance are:

- (1) Staffs who instill confident in users,
- (2) Making users feel safe in their transaction,
- (3) Keeping the dealings confidential,
- (4) Consistently courteous staffs,
- (5) Knowledgeable staffs to answer questions and
- (6) Informing new and up to date information.

## **d. Empathy**

The empathy Service Quality refers to how the company cares and gives individualized attention to their customers, to make the customers feeling extra valued and special. It is defined as the “caring, individualized attention the firm provides its

customer. In this study the empathy was measured using six items. The items used to measure empathy are:

- (1) Giving users individual attention,
- (2) Staffs deal with users in a caring fashion,
- (3) Staffs are approachable and easy to contact,
- (4) Staffs interested in solving any problem regarding the service,
- (5) Staffs understand the specific needs of user
- (6) Convenient business hour and
- (7) Convenient location of service facility.

#### **e. Tangibility**

The tangible Service Quality Dimension refers to the appearance of the physical surroundings and facilities, equipment, personnel and the way of communication. In this study the tangibility was measured using six items. The items used to measure tangibility are:

- (1) Modern Solar panel, battery, appliances,
- (2) Visually appealing facilities of SHS
- (3) Staffs have neat and professional appearance and
- (4) Visually appealing communication materials like leaflets, catalogs etc, are associated with the service.

#### **f. Technology**

Technical Quality is the quality of what consumers actually receives as a result of his/her interaction with the service firm and is important to him/her and to his/her evaluation of the quality of service (Groenroos, 1984). Frequently it can be measured by the consumer in a rather objective manner, as any technical dimension of a

product. A consumer will be influenced by the way in which the technical quality is transferred to him functionally. No measures have been developed to assess the technical quality of SHS service providers. Unlike the other service categories whose outcome may not be easily detected (e.g. beauty care, health care etc); SHS service users should be able to easily detect the service outcome. Eight items have been adopted from the study of Grönroos (1984); Lehtinen and Lehtinen (1982), Rust and Oliver (1994) and Brady and Robertson (2001). Also in-depth interview with group of experts in SHS industry like Area Managers of selected PO and users of SHS were conducted to generate items to assess technical quality in the current study.

The items used to measure technology are:

- (1) Successful to produce electricity,
- (2) No pollution to environment,
- (3) Supply electricity without any interruption,
- (4) Safe system,
- (5) Comfortable system to use
- (6) Available maintenance on a regular basis.
- (7) Available field level staffs to monitor service and
- (8) Prompt response to any complains.

### **g. Company Image**

According to Grönroos (1984) corporate image, or sometimes called local image of an office or organizational unit, is of utmost importance to most service firms. The expectations of the consumers are influenced by their view of the company, i.e., by the image. The corporate image is the result of how the consumers perceive the firm. Therefore, the corporate image can be expected to build up mainly by the technical



quality and the functional quality of its service. There are different levels of image (e.g. brand, product or company level) a consumer may associate with a service provider when asked to rate a company's overall image. The scales of items for Company Image were developed specifically for this study by adopting from the study of Groenroos (1982, 1990), Lehtinen and Lehtinen (1982) and Brady and Robertson (2001). In-depth interviews with industry experts, Area Managers of selected PO and users of SHS were conducted to generate items to assess perceived value in the current study.

In this study the image of PO was measured using six items. The items used to measure technology are:

- (1) Reliable PO,
- (2) Successful company and
- (3) Familiar Brand name of the PO is.

#### **4.5.2 Perceived Value**

Perceived value is claimed to be a major tool to help the service provider to gain a better competitive position in the market (Naumann and Giel, 1995; Woodruff, 1997; Parasuraman, 1997; Stahl et al., 1999; Cronin et al. 2000 and Huber et al., 2001) showed in their study that perceived value is the most significant factor for repurchase intention. So, to develop a long-term relationship with customers, perceived service value is very important for the SHS suppliers of the industry in Bangladesh. Perceived value is consisted of two dimensions called acquisition value and transaction value. Acquisition value is perceived net gains associated with the products and services acquired in consumption (Zeithaml, 1988). Transaction value is defined as the difference between consumers' internal reference price and the price offered within

the context of a special price deal (Grewal et al. 1998). Some meaningful scale of items developed by many scholars like “PERVAL” by Sweeney & Soutar (2001), were also adopted to develop this construct. In this study, four dimensional constructs namely functional (quality & performance), functional (price), emotional and social from PERVAL (Sweeney & Soutar, 2001) and five dimensional constructs of SERV-PERVAL (Petric, 2002) namely quality, monetary price, non-monetary price, reputation and emotional response were adopted to develop items of the construct. Other dimensions found previously by Lim et al (2006), Lee et al. (2007) were also adopted for developing the construct. Nine items have been developed by the author using 5-point scales anchored by “Strongly disagree” (1) and “Strongly agree” (5). The items used to measure technology are:

- (1) Compared to alternative energy sources, the service is worth of money (cost savings on electric bill),
- (2) Compared to alternative energy sources, the service is useful,
- (3) The PO helps to improve the service,
- (4) Quality of the service is outstanding,
- (5) Savings of time as the staffs install the system at house or shop,
- (6) Reasonable price of the system compared to other companies,,
- (7) Low maintenance cost,
- (8) Improvement of social status by using the service and
- (9) like to interact with those who have the same service.

### **4.5.3 Customer Satisfaction**

Customer Satisfaction is a judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption-related fulfillment (Oliver, 1997). Customer satisfaction is the outcome of customer's perception of the value received in a transaction or relationship, where value equals perceived service quality, compared to the value expected from transactions or relationships with competing vendors (Blanchard & Galloway, 1994; Heskett et al., 1990; Zeithaml et al., 1990). Given the nebulous and complex nature of customer satisfaction, its measurement is not an exact science and research in this area seems rather exploratory (Gilbert & Veloutsou, 2007). There is no commonly agreed method of measuring the concept and several theories of measuring customer satisfaction have been proposed by scholars. Among the most well-known are the confirmation-disconfirmation approach, the performance-only approach and the overall satisfaction approach. Thus, customer satisfaction can be highly personalized and therefore difficult to measure. From this literature five items were adopted to measure the customer satisfaction in this study. To measure customer satisfaction construct the 5 items scale has been used in the analysis. Here, the author used five-point Likert scale, ranging from 1= strongly disagree to 5=strongly agree. This questionnaire consists of seven major sections:

The items used to measure customer satisfaction are:

- (1) Overall satisfaction with the service,
- (2) Intention to say positive things about the PO to other people,
- (3) Intention to recommend the PO to others who seek advice,
- (4) Encourage friends and relatives to take service from the PO and
- (5) Expectation to have service from the PO in future.

## **4.6 Data Preparation**

Data preparation began with checking all questions for completeness. This was followed by editing, coding, and transcribing the data. Editing consisted of screening questionnaires to identify unreadable, incomplete, inconsistent or ambiguous responses. In examining the completeness of returned questionnaire, it was found that 36 questionnaires contained missing data. Among those cases 15 questionnaires had 90% or more of the overall questionnaires unanswered. These cases were omitted from the preliminary analysis. It was observed that 19 of 21 questionnaires had missing response to the likert scales sections. Respondents' lack of familiarity with this type of scale could be the main reason for missing data on those sections. Therefore upon deletion of 36 cases, 314 usable samples were retained in the database (89.71 % response rate) for further examinations of normality and outliers.

Coding was used to assign numbers to each possible response to each question and allowed the transference of data from the questionnaire to SPSS (Statistical Package for Social Sciences) version 20. For coding a data file was established in SPSS and all question items were pre-coded with numerical values. A code, usually a number was assigned to each. For data cleaning at first consistency checks were done. Data that were out of range, logically inconsistent and had extreme values were identified and corrected. Respondents with missing responses were discarded from the analysis which is known as Casewise deletion. The author then selected an appropriate data analysis strategy.

## **4.7 Data Analysis Methods**

This thesis used Statistical Package for Social Sciences (SPSS) version 20 to analyze the quantitative data gathered from the questionnaires. SPSS was used to assess the normality, reliability and validity of the distribution of data. To gain preliminary information about the sample SPSS was employed to conduct frequencies, mean, and standard deviation.

Exploratory factor analysis was used to assess the validity and reliability of measurement scales (Hair et al., 1998). Then Pearson Correlation and descriptive statistics were conducted to analyze the variables and test relationship between independents variables and the dependents variables (Foster et al., 1998). To determine the service quality dimensions of SHS service a Factor analysis was conducted. Finally, to test the research hypothesis Mediation analysis was conducted to examine the mediating effect of perceived value in hypothesized model. According to Baron and Kenny (1986), the mediator variable can be clearly judged when a previously significant effect of predictor variables is reduced to nonsignificant or reduced in terms of effect size after the inclusion of mediator variables into the analysis. These analyses were reported in chapter five.

# **CHAPTER FIVE**

## **SOCIO-ECONOMIC BACKGROUND OF BANGLADESH**

## **5.1 Introduction**

The current chapter provides the country profile of Bangladesh that is investigated from local literature and other secondary sources. In addition, it describes the current energy status and rural electrification and solar energy practice in Bangladesh. The purpose of this chapter is to review the empirical background of this study for analyzing the demand and supply gap of electricity in rural areas of Bangladesh.

This chapter comprises five sections. Following the introduction, the country profile of Bangladesh is presented in the second section. The third section describes the current energy status of the country. Rural electrification and solar energy practice in Bangladesh are the subjects of section four. The concluding section summarizes the key points.

## **5.2 Country Profile**

Official Name of Bangladesh is The People's Republic of Bangladesh. Bangladesh situated in the north-eastern part of south Asia. It is situated between 20°34' and 26°38' north latitude and between 88°01' and 92°41' east longitude. The total area is 56977 sq. miles or 147570 sq. km. The country is covered with a network of rivers and canals forming a maze of interconnecting channels. Bangladesh is predominately rich fertile flat land. Most parts of Bangladesh are less than 12 m (39.4 ft) above sea level. 17% of the country is covered by forests and 12% is covered by hill systems.

### **Population**

It is among the world's most densely populated nations (1099 people/km<sup>2</sup> in 2010) with a population of 152.25 million in 2012 (Statistical Pocketbook 2013, BBS). More than 75% of the population lives in rural areas. Total rural urban population is 107.35 million of them 54.22 million are male and 53.13 million are female whereas total population in rural is 41.7 million of them 29.1 million are male and 12.6 million are female (Statistical Pocketbook 2013, BBS).

### **Religion**

The majority (about 88.8%) of the people are Muslim. Other main religions namely Hinduism, Buddhism, Christianity are practiced in peace and harmony.

### **Language**

Over 98% of the people of Bangladesh speak in Bangla.

### **Economy**

Bangladesh is a developing country. It has an agrarian economy, although the share of agriculture to GDP has been decreasing over the last few years. Yet it dominates the economy accommodating the major rural labour force. Per capita GDP (in BDT) is



increasing. In 2010-11 it was 25730, in 2011-12 it was 26986 and in 2011-12 it is 28237. Real GDP growth rate is 6.03 in 2011-12. The total employed population in 2010 is 54.1 million of them 37.9 million are male and 16.2 million are female. Of the total employed people 2.4 million are professional, technical; 0.7 are administrative, managerial; 1.0 are clerical workers; 8.2 are sales workers; 3.0 are service workers; 25.7 are with agriculture, forestry & fisheries and 13.5 are production & transport labourers & others. Among the total unemployed population of 2.6 million in 2010, 1.6 million are male and 1.0 million are female. And among the total rural unemployed people of 1.7 million, 1.1 million are male and 0.6 million are female. The unemployment rate in 2010 is 4.5% of which male unemployment rate is 4.1 % and female unemployment rate is 5.8%.

### **Administrative Units**

As on 31<sup>st</sup> December 2013, there are total 7 Divisions, 64 Zilas, 545 Thana/Upazilas, 4562 Unions, 87191 villages and 310 paurashavas. The data has been summarized in table 5.1. The Capital is Dhaka. Each of the eight administrative divisions named after their respective divisional headquarters: Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Sylhet and Rangpur. Divisions are subdivided into districts (Zia). There are 64 districts in Bangladesh, each further subdivided into upazila (sub districts) or Thana. The area within each police station, except for those in metropolitan areas, is divided into several unions, with each union consisting of multiple villages. In the metropolitan areas, police stations are divided into wards, which are further divided into Mahallas.

**Table 5.1: Administrative Units of Bangladesh**

Division/Zila	Area in Square Kilometre	Upazila/Thana	Union	Village	Paurashava
1. Barisal Division	13226	40	349	4097	24
2. Chittagong Division	33908	112	947	15219	59
3. Sylhet Division	12635	38	333	10250	19
4. Dhaka Division	31178	163	1256	25213	85
5. Khulna Division	22285	64	574	9287	36
6. Rajshahi Division	18154	70	564	14075	59
7. Rangpur Division	16185	58	539	9050	20
Total	147570	545	4562	87191	310

Source: Statistical Pocketbook 2013, BBS

### **Main Seasons**

There are six seasons in the country which are Summer, Rainy season, Autumn, Late Autumn, Winter and Spring season. Bengali months “Baishakh” and “Jaishtha” constitute Summer, “Ashar” and “Sraban” are the months of the Rainy Season, “Bhadra” and “Aswin” are the months of Autumn, “Kartik” and “Agrahayan” constitute Late Autumns, “Poush” and “Magh” are the seasons of Winter and “Falgun” and “Chaitra” are the months of Spring.

### **Principal Industries**

Main industries of the country are readymade garments, textiles, chemical fertilizers, pharmaceuticals, tea processing, paper & Newsprints, cement, light engineering, sugar, leather goods etc. In 2012-13, total BDT 1894.37 billion was earned from export and BDT 2707.76 billion was expended for import.

### **Education**

Bangladesh has a low literacy rate. The literacy rate of population for aged above 15 years reached 59.82 per cent while the illiteracy rate is 40.18 and the literacy of women is 55.71 per cent (BSS, 2013). The education system is divided into five

levels: Primary (from grades 1 to 5), Junior Secondary (from grades 6 to 8), Secondary (from grades 9 to 10), Higher Secondary (from grades 11 to 12) and tertiary. Universities in Bangladesh are mainly categorized into three types: public (government owned and subsidized), private (private sector owned universities) and international (operated and funded by international organizations). Bangladesh has 34 public, 60 private and two international universities. Bangladesh National University has the largest enrollment among them and University of Dhaka (established 1921) is the oldest. Medical education is provided by 23 government and 48 private medical colleges. All medical colleges are affiliated with Ministry of Health and Family Welfare. Number of educational institutions is increasing also which is summarized in table 5.2.

**Table: 5.2: Total Number of Educational Institutions:**

<b>Institutions</b>	<b>2010-2011</b>	<b>2011-2012</b>	<b>2012-2013</b>
Public Universities	31	34	34
Private Universities	51	52	60
Govt. Medical Colleges	18	21	23
Private Medical Colleges	30	42	48
General Colleges	3,324	3,475	3,547
Govt. Polytechnic Institutes	46	46	46
Private Polytechnic Institutes	125	125	172
Secondary Schools	19,040	19,070	19,208
Govt. Secondary Schools	312	317	318
Primary Schools	78,685	78,685	1,04,017

Source: Statistical pocketbook 2013, BBS

Students' enrollment in different types of institutions is also increasing. In 2012 total 18,90,543 students enrolled in public universities, 30,44,320 in college, 7,79,37,235 in secondary school and 1,90,03,210 in primary schools.

### 5.3 Current Energy Status in Bangladesh

Per-capita consumption of commercial energy and generation of electricity in Bangladesh is one of the lowest among the developing countries. The country has been facing a severe power crisis for about a decade. Bangladesh's power system depends on fossil fuels supplied by both private sector and state-owned power plants. At present about 65% of total final energy consumption is met by different types of biomass fuels (e.g. agricultural residues, wood fuels, animal dung etc). So with the exception of kerosene, commercial fuels are beyond reach for many. Today only around 49% of the Bangladesh population is connected to the electricity grid. Due to the lack of electricity supply in rural areas, the rural population depends mainly on firewood, crop residues like jute sticks, dried leaves, cow dung, kerosene, rice straw etc as a source of energy. Most people in the rural areas depend on kerosene lamps for light. Over 90% of total primary energy consumption is covered by biomass, mainly agricultural waste, wood and cow dung. The data is shown in figure 5.1.

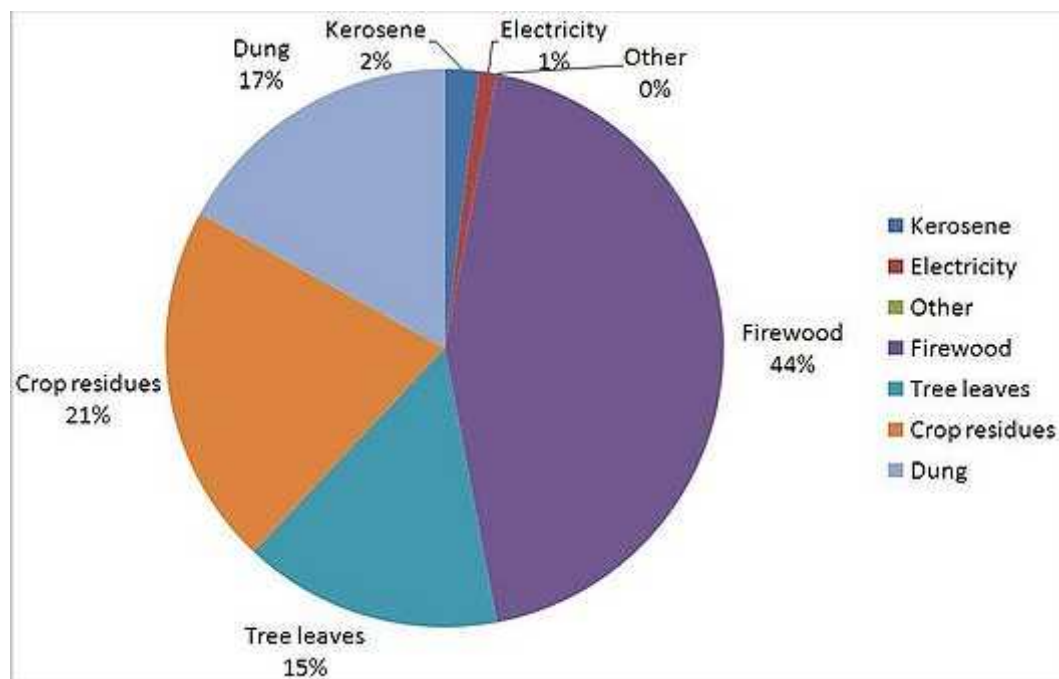


Figure 5.1: Bangladesh rural household consumption of energy

A mere 6% of the entire population has access to natural gas, primarily in urban areas. The country's power generation plants are dated and may need to be shut down sooner rather than later. In addition, the present gas production capacity in Bangladesh cannot support both domestic gas needs, as well as wider electricity generation for the country. The reserved gas is gradually reducing and no more gas field is discovered. So far in Bangladesh 23 gas fields have been discovered with the rate of success ratio is 3.1:1 of which two of the gas fields are located in offshore area. In 2012 total of 800.72 billion cubic feet gas is produced from 20 gas fields. At this rate, the proven reserve of natural gas may not last more than 10 years. To reduce the dependency on natural gas, alternative energy resource must be explored. At the same time demand of energy especially electricity is gradually increasing. The rate of increase in electricity consumption is 10% annually. So we need to find alternative electricity sources to satisfy demand. Under these circumstances Renewable Energy sources like solar, biomass, wind, hydro etc, could potentially be a positive alternative in providing affordable electricity. The Government of Bangladesh (GOB) is actively engaged in energy crisis management. In 2008 GOB prepared the "Renewable Energy Policy" in order to generate environment-friendly power from renewable energy. The Renewable Energy Policy envisions that 5% of total energy production will have to be achieved by 2015 and 10% by 2020. Various action plans have already been prepared to achieve this target. GOB is placing priority on developing Renewable Energy resources to improve energy security and to establish a sustainable energy regime alongside of conventional energy sources. In line with the Renewable Energy policy 2009, the Government is committed to facilitate both public and private sector investment in Renewable Energy projects to substitute indigenous non-renewable energy supplies and scale up contributions of existing Renewable Energy based

electricity productions. Moreover, GOB has been working to finalize the Sustainable Energy Development Authority Act, 2011. Government has already launched "500 MW Solar Power Mission" to promote the use of Renewable Energy to meet the increasing demand of electricity. In line with the Renewable Energy policy 2009, the Government is committed to facilitate both public and private sector investment in Renewable Energy projects to substitute indigenous non-renewable energy supplies and scale up contributions of existing Renewable Energy based electricity productions. Government incentives for companies setting up solar plants include a 15-year tax holiday and exemption from paying import duty on equipment. Foreign investors get exemptions on royalties, technical knowhow, technical assistance fees and facilities for their repatriation of profits. Foreigners working in solar energy projects need pay no income tax for the first three years of their stay in this country. In 2009, the Bangladesh Bank set up a US\$29m fund to promote solar power. Private commercial banks and state-owned banks signed an agreement with the central bank that allowed banks to draw money from this fund under a refinancing scheme with a low-interest interest rate of 5%. The banks could then lend the funds to borrowers from the solar power sector at a ceiling interest rate of 10%. In March 2011, the country set a target to install 500 megawatts of electricity via solar home systems to combat greenhouse gas emissions and to ensure sustainable development in energy. The plan is to use Asian Development Bank (ADB) solar power project funds to achieve the electricity generation target.

But under the existing generation scenario of Bangladesh, Renewable Energy has a very small share to the total generation. The share of Renewable Energy exceeds more than 1% till now. Renewable energy produces close to 20 MW of electricity with solar being the dominant source. The data is shown in table 5.3.

**Table 5.3: Energy and Power source**

Energy and Power source	Source use 2008
Natural Gas	600 bcf
Oil	3.7 mio. tons
Hydro	1.0 Twh
Biomass	55 mio. Tons
Solar PV	18 MW
Wind	1 MW

Source: Annual report 2014-2015, BPDB

#### **5.4 Current Status of Electricity in Bangladesh:**

Electricity is the major source of power for most of the country's economic activities. In 2012-13 the per capita electricity generated is 248.89 but per capita electricity consumed is 213.15 (Bangladesh Power Development Board, 2013). After system losses, the country's installed capacity for electricity generation can generate 3,800 megawatts of electricity per day; however, daily demand is near 6,000 megawatts per day. In general, rapid industrialization and urbanization has propelled the increase in demand for energy by 10% per year. Electricity is consumed by different sectors of the country such as in domestic service, agriculture, industrial service, commercial service etc. Majority users are from domestic followed by industry, commercial service, agriculture and others. The data is presented in table 5.4.

**Table 5.4: Consumption of Electricity by Category (2008-09 to 2012-13)**  
(Unit in MKWH)

Year	Domestic Service	Agriculture	Industrial service	Commercial service	Others	Total
2008-09	10053	1172	7626	2054	850	21755
2009-10	11623	1229	9002	2336	406	24596
2010-11	12757	1269	9566	2574	413	26579
2011-12	14678	1492	10579	2751	473	29974
2012-13	16351	1512	11445	2996	436	32740

Note: MKWH= Million Kiolwatt hours

Source: Bangladesh Power development Board, Ministry of Power, Energy and Mineral Resources

The maximum demand for electricity is increasing every year. The total demand was 6066 MW in 2011-12 and 6434 MW in 2012-13. This is summarized in table 5.5.

**Table 5.5: Maximum Demand for Electricity (2008-09 to 2012-13)**

year	Maximum demand (MW)			% Change over preceding year
	East zone	West zone	System total	
2008-09	3589	573	4162	0.78
2009-10	3883	723	4606	10.67
2010-11	3962	928	4890	6.17
2011-12	4805	1261	6066	24.05
2012-13	5010	1424	6434	6.07

Note: MW: Mega Watt

Source: Bangladesh Power development Board, Ministry of Power, Energy and Mineral Resources.

The electricity consumption is increasing every year in comparison to electricity generation. This is shown in figure 5.2.



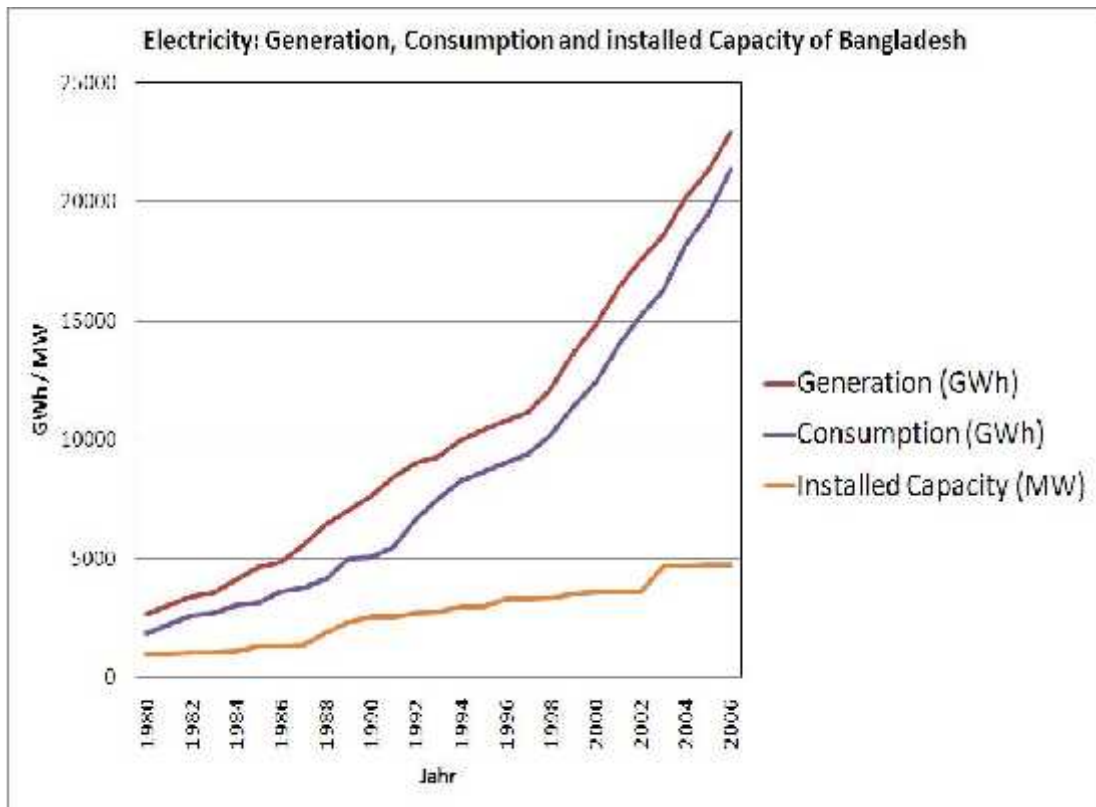


Figure 5.2: The electricity, generation, consumption and installed capacity of the country

Source: BPDB, 2009

Overall, the country's generation plants have been unable to meet system demand over the past decade. Most of the electricity is generated from natural gases (around 62%). Electricity also generated from other sources such as diesel, coal etc and a little portion of electricity is generated from the renewable sources. According to BPDB (2012) about 61.99% of the power plants are fired by gas. Furnace oil, diesel, coal and hydro power are responsible for 21.3%, 8.47%, 1.83 % and 2.10 % of the total electricity supply respectively. The data is shown in table 5.3. The acute gas shortage causes a loss in production of around 600MW.

**Table 5.3: Electricity Generation (million KWH)**

Source	Electricity production	Fraction of Total production (in %)
Hydro	230	2.10
Furnace Oil	2301	21.3
Natural Gas	6781	61.99
Power import	500	4.57
Diesel	927	8.47
Coal	200	1.83

Source: Annual report 2014-2015, BPDB

Presently, there are three state-owned enterprises generate and transmit electricity in the country. They are:

Bangladesh Power Development Board (BPDB) responsible for generation and transmission of power in the urban areas except the are under greater Dhaka; Dhaka Electricity Supply Authority (DESA) responsible for distribution of electricity in the greater Dhaka are including the metropolitan city of Dhaka; and Rural Electrification Board (REB), responsible for distribution of electricity in rural areas.

Primary grid system of Bangladesh as on June, 2015 by Directorate of System Planning BPDB has been shown in figure 5.3.

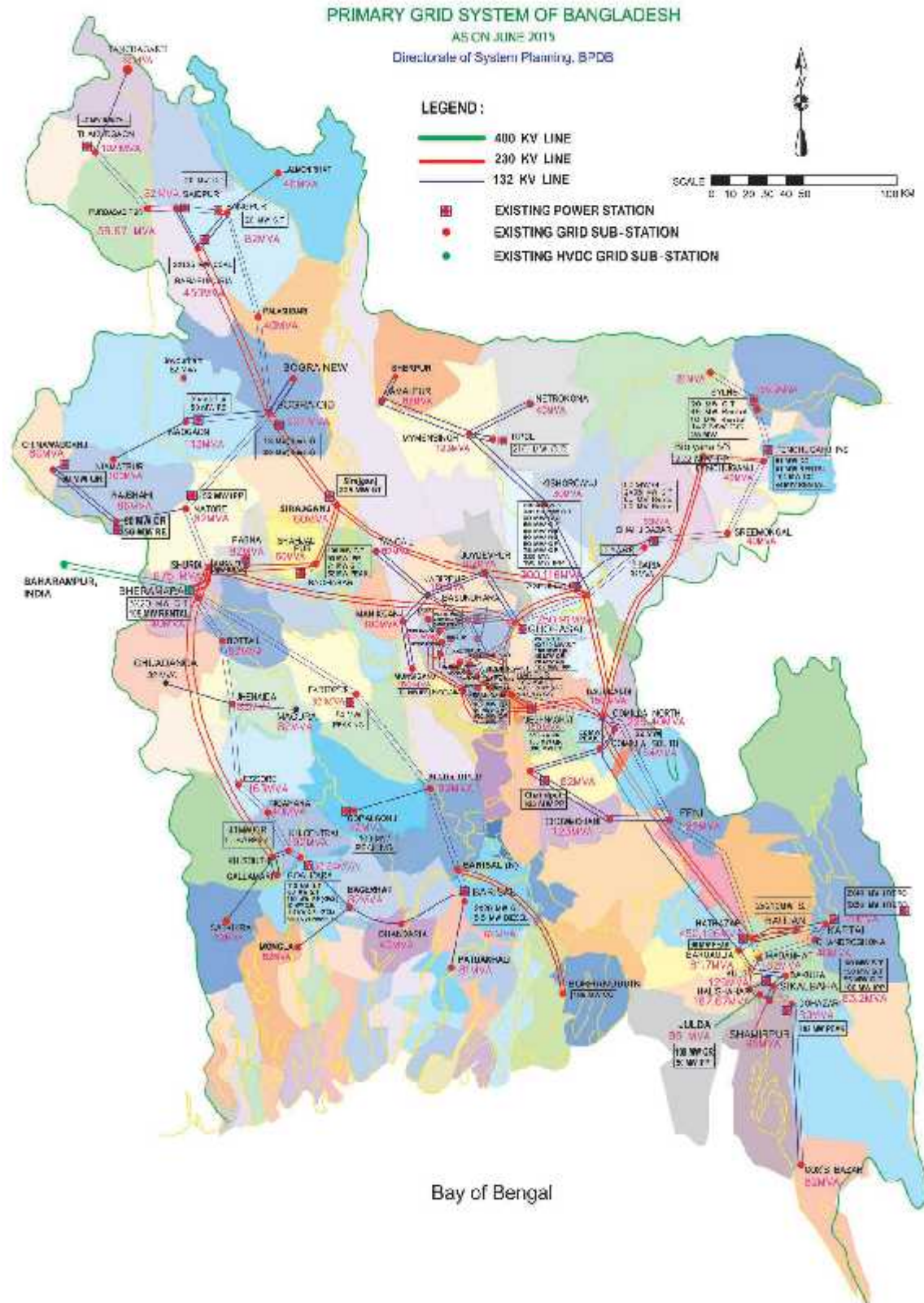


Figure 5.3: Primary grid system of Bangladesh (BPDB, 2009)

Most of the villages in Bangladesh are not connected to the national grid only 57551 villages are connected. Today only around 42% of the Bangladesh population is connected to the electricity grid. Most people in the rural areas depend on kerosene lamps for light. Due to the lack of electricity supply in rural areas, the rural population depends mainly on biomass as a source of energy such as agricultural waste and wood. Problems in the Bangladesh's electric power sector include corruption in administration, high system losses, delays in completion of new plants, low plant efficiencies, erratic power supply, electricity theft, blackouts, and shortages of funds for power plant maintenance. The Government of Bangladesh is actively engaged in energy crisis management. The National Energy Policy has the explicit goal of supplying the whole country with electricity by 2020. Eliminating load shedding and increasing access extend electrification to all Bangladeshis by increasing the installed capacity to 20,000 MW by 2021 are central to *Vision 2021*, which is the Government's plan to make Bangladesh a prosperous, middle-income country 50 years after independence. But achieving 100 percent electrification will be difficult because Bangladesh is a low-lying delta crisscrossed by hundreds of rivers. This topography contributes to the 30,000Tk (\$430)1 cost of extending an existing grid connection by one kilometer (Barua et. al. 2001). According to Rural Electrification Board (REB) estimates, extending the grid to marginal service areas would “cost approximately US\$13 billion. So the solar electricity can illuminate a less expensive method of extending electricity to off-grid areas in Bangladesh.

In 2008 GOB prepared the “Renewable Energy Policy” in order to generate environment-friendly power from renewable energy sources. The Renewable Energy Policy envisions that 5% of total energy production will have to be achieved by 2015 and 10% by 2020. Various action plans have already been prepared to achieve this

target. GOB is placing priority on developing Renewable Energy resources to improve energy security and to establish a sustainable energy regime alongside of conventional energy sources. Government has already launched "500 MW Solar Power Mission" to promote the use of Renewable Energy to meet the increasing demand of electricity. In line with the Renewable Energy policy 2009, the Government is committed to facilitate both public and private sector investment in Renewable Energy projects to substitute indigenous non-renewable energy supplies and scale up contributions of existing Renewable Energy based electricity productions. Government incentives for companies setting up solar plants include a 15-year tax holiday and exemption from paying import duty on equipment. Foreign investors get exemptions on royalties, technical knowhow, technical assistance fees and facilities for their repatriation of profits. Foreigners working in solar energy projects need pay no income tax for the first three years of their stay in this country. In 2009, the Bangladesh Bank set up a US\$ 29 million fund to promote solar power. Private commercial banks and state-owned banks signed an agreement with the central bank that allowed banks to draw money from this fund under a refinancing scheme with a low-interest interest rate of 5%. The banks could then lend the funds to borrowers from the solar power sector at a ceiling interest rate of 10%. In March 2011, the country set a target to install 500 megawatts of electricity via solar home systems to combat greenhouse gas emissions and to ensure sustainable development in energy. The plan is to use Asian Development Bank (ADB) solar power project funds to achieve the electricity generation target. Moreover, GOB has been working to finalize the Sustainable Energy Development Authority Act, 2011. Solar panels have already been installed in various public and private organizations including the Prime Minister's Office and Bangladesh Bank. Steps have been taken to set up 10-15

MW solar energy based power stations at 4 different places in the country. All new buildings will also be asked to prepare for solar power installation Plans for tendering four solar power projects with generation capacity of 10 MW are under development Solar power equipment can be made locally. Government hopes that solar panel manufacturing/ assembling will soon take place in Bangladesh and government seems ready to support with climate funds, land areas etc.

The renewable energy project of GOB is following two different methodologies to extend off-grid solar to rural Bangladesh: fee-for-service and ownership. The fee-for-service model is offered by the Rural Electrification Board (REB). REB will supply the Solar Home Systems through its PBSs by a fee for service scheme charges households a fixed monthly fee to use the solar home system (SHS) installed in their roofs (World Bank 2009). Indeed, REB was only able to install 12,000 of the targeted 16,000 SHS under World Bank-financed Rural Electrification and Renewable Energy Development (RERED) Program from 2003–2009 (World Bank 2009). The same institutional constraints that limited SHS deployment also undermined after sales service, causing many systems to go into poor condition.

Conversely, the ownership model, which uses microfinance to sell SHS to rural households, has been highly successful. The project aimed to finance the sale of SHS to customers by extending grants and soft loans to the Infrastructure Development Company Limited (IDCOL), a non-bank financial institution established by the Government in 1997 to finance infrastructure development and renewable energy projects (IDCOL 2008). Funding for SHS from other development agencies such as GTZ and KfW were also channeled through IDCOL (IDCOL 2008). Infrastructure Development Company Limited (IDCOL) would implement it through the participating organizations, which could be NGOs, MFIs and Private sector agencies.

All customers are required to pay at least ten percent of the remaining cost as a down payment. The outstanding amount is covered by a loan financed jointly by the PO (20 percent) and IDCOL (80 percent). This loan is paid back via a series of monthly installments that generally continues for 24 or 36 months. IDCOL receives World Bank financing for its portion of the loan and uses this money to extend “soft loans of 10-year maturity with 2-year grace period at 6% per annum interest to its partner organizations”. After a household purchases a SHS, it is guaranteed free after sales service throughout the duration of the payback period. Because the field officers that sell, install and fix minor problems are also the bill collectors, customers can receive basic maintenance services when they pay their monthly installments. Once a household finishes paying off its system and becomes its outright owner, however, the free maintenance services end. RERED reached its target of selling 50,000 SHS in August 2005 and financed a total of 320,000 SHS in off grid area before the project ended in December 2009. The World Bank renewed the project through the end of 2012 and set a new target of 300,000 addition SHS installations. In this way, Solar photovoltaic (PV) systems are in use throughout the country with over 2.9 million household-level installations having a capacity of 122.2 MW by April 2014.

A number of pilot projects on solar grid power are also running successfully by Government. Under the Hill Tracts Electrification Project BPDB has already implemented three solar projects in Juraichori Upazilla, Barkal Upazilla and Thanchi Upazilla of Rangamati District. Under 1st, 2nd and 3<sup>rd</sup> Phases, 1200 sets Solar Home Systems of 120 Wp each, 30 sets Solar PV Street Light Systems of 75 Wp each, 3 sets Solar PV Submersible Water Pumps of 1800 Wp each, 6 sets Solar PV Vaccine Refrigerators for the Health Care Centers of 360 Wp each and 2 sets 10 kWp capacity Centralized Solar System for market electrification has been installed. So, a total of

173.81 kWp Solar PV Systems have been installed in Juraichori, Barkal and Thanchi upazilla of Rangamati District under the Hill Tracts Electrification Project.

Steps have been taken to set up 10-15 MW solar energy based power stations at 4 different places in the country. All new buildings will also be asked to prepare for solar power installation Plans for tendering four solar power projects with generation capacity of 10 MW. Government has in principal decided to install solar power units in all public and semi public offices. Solar panels have already been installed in various public and private organizations including the Prime Minister's Office and Bangladesh Bank. BPDB implemented 20.16 kWp Solar PV System and that was inaugurated by Prime Minister at the Office of the Prime Minister on December 2009. Installation has also taken place at the Bangladesh Bank.

In the fiscal year 2008-09, BPDB implemented another two solar electrification projects in Angoorpota and Dohogram Chit Mohol. Under this program, BPDB implemented 2 sets Solar Home System of 50Wp each, 2 sets Solar Home System of 80Wp each and 8 sets Solar Home System of 100Wp each. A total of 1.06 kWp Solar PV Systems have been installed in Angoorpota and Dohogram Chitmohol.

Since November 2010, the government has mandated the installation of roof-top solar panels on all new high-rise buildings, and it currently has other solar power projects under development with a total capacity of 35 MW. Under the plan, 340 MW of new capacity will be generated from systems in-stalled on residential, commercial and industrial buildings, as well irrigation pumps, mini-grid systems and solar parks. Major solar PV systems implemented by BPDB in the fiscal year 2010-2011 are: 32.75 kWp at WAPDA Building, Motjheel; 2.82 kWp at Chairman Banglo, BPDB; 6 kWp at Agrabad Bidyut Bhaban, Chittagong; 1.8 kWp at Cox's BPDB Rest House.



In March 2011, the country set a target to install 500 megawatts of electricity via solar home systems to combat greenhouse gas emissions and to ensure sustainable development in energy. The plan is to use Asian Development Bank (ADB) solar power project funds to achieve the electricity generation target. Moreover, GOB has been working to finalize the Sustainable Energy Development Authority Act, 2011. Major solar PV systems implemented in the fiscal year 2011-2012 are 7.5 kWp Solar Roof Top System on 15th floor of Bidyut Bhaban; 3 kWp at PC Pole Factory, Chittagong; 3 kWp at Khagrachori BPDB Rest House; 2.16 kWp at Swandip Power House and Rest House; 2.16 kWp at Sales & Distribution Division, HatHajari; 3.12 kWp at Sales & Distribution Division, Fouzdarhat; 3.12 kWp at Sales & Distribution Division, Rangamati; 1.6 kWp Solar Power System at Titas 50 MW Peaking Power Plant; 1.6 kWp Solar Power System at t Baghabari 50 MW Peaking Power Plant; 1.6 kWp Solar Power System at Bera 70 MW Peaking Power Plant; 1.5 kWp Solar Power System at Chittagong Power Plant; 3.5 kWp Solar Power System at Ghorashal Power Plant.

In the fiscal year 2012-2013 BPDB has implemented the following solar PV systems: 4 kWp Solar Power System at Khulna Power Station; 1.6 kWp Solar Power System at Faridpur 50 MW Peaking Power Plant; 1.6 kWp Solar Power System at Goplagonj 100 MW Peaking Power Plant; 2 kWp at Sales & Distribution Division, Bakolia; 2 kWp at Sales & Distribution Division, Pathorghata and Madarbari; 2 kWp at Sales & Distribution Division, Stadium; 2 kWp at Sales & Distribution Division, Agrabad; 2 kWp at Sales & Distribution Division, Halishohor; 2 kWp at Sales & Distribution Division, Khulshi; 2 kWp at Sales & Distribution Division, Pahartoli; 2 kWp at Sales & Distribution Division, Mohora; 2 kWp at Distribution Division, Patiya; 2 kWp at Distribution Division, Bandarban; 6 kWp at Regional Civil Construction Division,

Medical centre and Magistrate Building; 2 kWp at Sales & Distribution Division, Feni; 2 kWp at Sales & Distribution Division, Chowmuhuni, Noakhali; 1 kWp Solar Power System at the non-residential building and 2 kWp Solar Power System at the residential building of Santahar 50 MW Peaking Power Plant; 1 kWp Solar Power System at the non-residential building and 2 kWp Solar Power System at the residential building of Katakhalı 50 MW Peaking Power Plant; 1.6 kWp Solar Power System at Dohazari 100 MW Peaking Power Plant; 27.2 kWp Solar Power System at Chandpur 150 MW Combined Cycle Power Plant and 25 kWp Grid Tied Power System at Chittagong Power Station.

Government hopes that solar panel manufacturing/ assembling will soon take place in Bangladesh and government seems ready to support with climate funds, land areas etc. Seven city corporations have got solar street lights by 2015, which ensured persistent light on city streets during nighttime and will eventually increase the security of city-dwellers. The government has set a target of generating 500 megawatts (MW) of green energy that is almost ten times the current amount by 2015, in an attempt to narrow the gap between current supplies of grid electricity and the needs of the country's 160 million people. The government believes investments totaling \$2.24 billion will be required to reach its solar power target. It is seeking about \$1.6 billion in financing from the Asian Development Bank (ADB) and other development partners. The plan calls for the remainder to be funded by the government and the private sector.

## **5.5 Conclusion**

The off-grid solar sector in Bangladesh has brought a superior form of lighting to millions of rural Bangladeshis, created thousands of jobs and provided rural people with new opportunities for income generation. Bangladesh did not create a new technology to build this industry; rather, it was succeeded because it was the first place to find a mechanism (microfinance) for putting the technology (Solar Home System) into the hands of the rural poor. So, other countries look to extend energy services to rural areas, they should look to the Bangladesh model as one that succeeded through its leveraging of local advantages, clear policies and patience.

**CHAPTER SIX**  
**SOLAR HOME SYSTEM**  
**INDUSTRY OF BANGLADESH**

## **6.1 Introduction**

This study aims to contribute to the understanding of service quality and customer satisfaction of the Solar Home System service in Bangladesh. So it is important to comprehend the dynamics of this industry from the perspective of the customer who is the final arbiter of how to purchase and use the system. The current chapter provides the background to the study area that is investigated from local literature and other secondary sources. The status of rural electrification in Bangladesh, the relative importance of solar electrification prevailing SHS service in Bangladesh, current practices of the SHS industry and the problems faced in the industry are investigated from secondary data. The purpose of this chapter is to review the empirical background of this study for establishing the need to investigate the customer dissatisfaction problems of the rural people.

This chapter comprises five sections. Following the introduction, the status of rural electrification in Bangladesh is presented in the second section. The third section depicts the relative importance of solar electrification. SHS services in Bangladesh are the subject of section four. Current practices of the industry are canvassed in next section. Problems faced in the industry are addressed in the next section. The concluding section summarizes the key points.

## 6.2 The Status of Rural Electrification in Bangladesh

Availability of adequate electricity is an indicator of the standard of living of a country. But the Access to electricity in Bangladesh is one of the lowest in the world; coverage today stands around 49% of the total population (Ministry of Power 2010). The chances of reaching the remaining 58% of the people by conventional power may not likely to happen in near future. Moreover, in the rural areas, where more than 70% of the population lives, only 25% of them have electricity and about 16 million households yet to be electrified (<http://climatechange.worldbank.org/>). Although most of the villages in Bangladesh are not connected to the national grid but a significant number of consumers from different sectors are consuming electricity and they are dependent on that. The major consumption of rural electricity is found in domestic which is followed by industry, commercial, irrigation and others. The data is summarized in table 6.1.

**Table 6.1: Sector wise number of consumers of Rural Electricity (2008-09 to 2012-13)**

(Unit in MkWh)

Year	Domestic	Industrial	Commercial	Irrigation	Others	Total
2008-09	4193275	2596038	702249	1013825	13989	8519376
2009-10	4205846	2605773	704776	1015154	14455	8546003
2010-11	5505008	2961472	922422	1076357	14436	10479695
2011-12	6436271	3403427	1029600	1237289	157124	12263711
2012-13	7323636	3887173	1117360	244921	80830	13753920

Note: MWh= Mega watt hours

Source: Rural Electrification Board, Ministry of Power, Energy and Mineral Resources

Only 48.84% of rural people are using electricity and 47% are using kerosene, biogas and other and 4% are using solar as source of light. Whereas 88.7% urban households are using electricity, 11% are using kerosene, biogas and other and only 0.45% is using solar energy as source of light. The total house reporting source of light is summarized in table 6.2.

**Table 6.2: Household reporting source of Light**

Local ity	Source of Light						Source of Light (%)					
	Total	Electricit y	Solar Ener gy	Kerosin e	Biog as	other	Electric ity	Solar Ener gy	Kerosi ne	Biog as	othe r	total
Total	31705 684	1794503 1	1051 736	125213 49	4104 07	1461 61	56.60	3.32	39.49	0.13	0.46	100
Rural	25535 877	1247270 1	1023 926	118609 10	3919 6	1391 43	48.84	4.01	46.45	0.15	0.54	100
Urba n	61698 07	5472330	2780 9	660440	2210	7018	88.70	0.45	10.70	0.04	0.11	100

Source: Population Census Sample Survey, 2011, BBS.

Supply of grid electricity at present faces many constraints including capacity shortages, high cost of fossil fuel, and lack of finance while the demand for electricity is rising due to increased income, urbanization and other factors. So to supply electricity with quality light, reliable service and long term sustainability, Solar Energy System is considered as an important emerging option by the policy makers. Solar Energy is inexhaustible and pollution free. Solar Home System use solar energy for generation of electricity. Photovoltaic (Photo for light and Voltaic for Battery or Solar Cells) convert sunlight directly into electricity and does not require any kind of conventional fuels.

The tropical climate of Bangladesh is an advantage to the utilization of solar energy resources to meet various energy needs. Bangladesh is situated between 20°34' and 26°38' north latitude and between 88°01' and 92°41' east longitude which is an ideal location for solar energy utilization. But the Solar radiation varies from season to

season in Bangladesh. Maximum amount of radiation are available in the month of March-April and minimum in December-January. So we might not get the same solar energy all the time. In figure 6.1 the monthly average solar radiation pattern is shown.

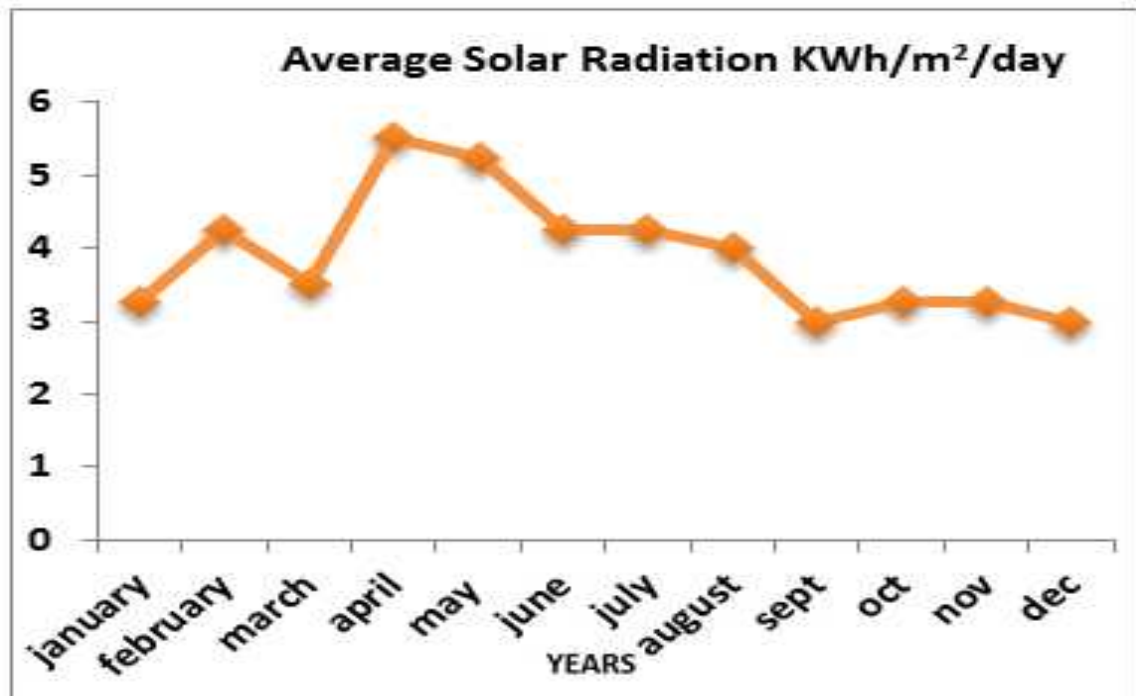


Figure 6.1 Monthly average solar radiation in Bangladesh

Daily average solar radiation varies between 4 to 6.5 KWh per square meter which is 50%-100% higher than Europe. Annual amount of solar radiation in Bangladesh varies from 1,840 to 1,975 kWh/m. Taking an average solar radiation of 1900 kWh per square meter, total annual solar radiation in Bangladesh is equivalent to  $1,010 \times 10^{18}$  J and the total yearly consumption of energy in Bangladesh was about  $1,000 \times 10^{15}$  J in 2003. Even if 0.1% of the incident radiation could be utilized, total requirement of energy in the country could be met. Although yearly energy consumption in Bangladesh has increased in recent years, it is obvious that less than 1% of the incident radiation in Bangladesh can meet present day's demand. This report also calculated that taking 10% efficiency for the solar cell, the estimated PV



electricity generation potential was 50,436 MW. So, there is great possibility of using this energy source for solar home system in our country.

## **6.3 Relative Importance of Solar Home System**

### **What is a Solar home System:**

Solar Energy is a great source for solving power crisis in Bangladesh. Solar Home System use solar energy for generation of electricity. Photovoltaic (Photo for light and Voltaic for Battery or Solar Cells) convert sunlight directly into electricity and does not require any kind of conventional fuels.

Solar home systems (SHS) are small, stand-alone electrical systems that consist of a photovoltaic (PV) module which generates electricity from sunlight; a rechargeable battery which stores electricity so that it can be used during both day and night; a charge controller which prevents the battery from being over-charged or deep-discharged and fluorescent lamps, wiring and fixtures.

- A Home System consists of the following:
- A solar panel (may contain a number of modules),
- A storage battery for storage of electric energy. When needed, this stored energy is converted into electricity for use,
- A blocking diode to avoid discharge of battery through the solar panel,
- A charge controller which controls charging and discharging of the storage batteries and
- An inverter to convert direct current (DC) into alternating current (AC) which is optional and is attached only when AC at 220V is required.

All modules frames and mounting racks must be properly grounded.

## Technology:

When a photon strikes one of the electronically connected photovoltaic cells that comprise an array, electrons flow from the phosphorous-doped silicon region (N-type) of the cell through the load as direct current before returning to the boron-doped (P-type) silicon region of the cell. The type of appliances, number of appliances that can be used simultaneously and duration of use is contingent upon the size of the system and the amount of sunlight it receives. A typical SHS is shown in Figure 6.2.

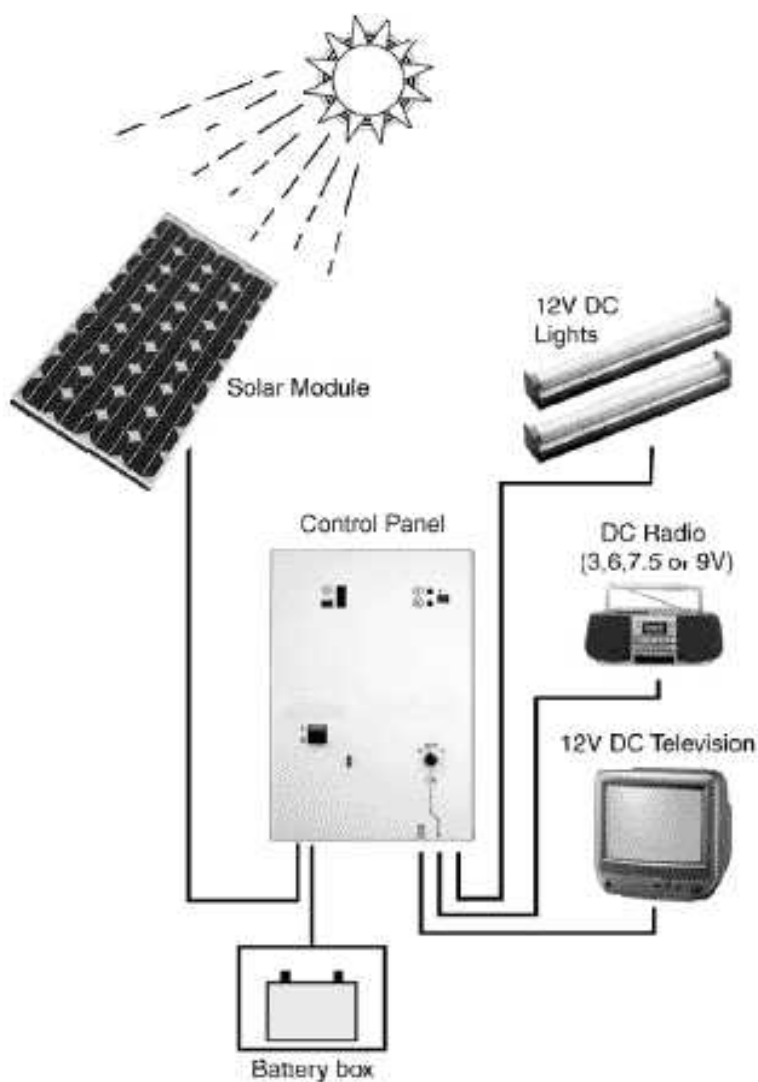


Figure 6.2: A typical SHS

Solar Home Systems can be used to light up homes, shops, fishing boats etc, and also to charge cellular phones, run televisions, radios and cassette players. It can directly reduce considerable amount of green house gasses like CFC by substituting kerosene lamps and eventually keep our environment healthy. So the rural electrification through solar Photovoltaic technology is becoming very popular, day by day in Bangladesh particularly for remote, inaccessible areas where there still exists no infrastructure for conventional energy supply.

POs offer various capacities of SHSs. These range from 20 Wp to 135 Wp and all types of capacities in between. Usually with a SHS of 20 Wp capacity rural people can use two lights and one mobile charger for 4-5 hours and with 50 Wp capacity they can use four lights, one black and White TV and one mobile charger for 4-5 hours. Number of lighting points varies by capacity and mostly the use is for 2-5 lighting points varying monotonically as the capacity increases with 2 points for 20 Wp and 6 for 85 Wp. Three types of SHS with different capacity are presented with supporting appliances and duration of operation are presented in table 6.3. These are offered on credit and also on cash terms basis.

**Table 6.3: Different types of SHS:**

<b>Capacity</b>	<b>Appliances</b>	<b>Operation</b>
20Wp	2 Lamps of 8 watt and 1 Mobile Charger	4-5 hours
50Wp	4 Lamps of 8 watt, 1 Black and White TV and 1 Mobile Charger	4-5 hours
85Wp	9 Lamps of 8 watt, 1 Black and White TV and 1 Mobile Charger	4-5 hours

Note: Wp = Watt peak

## **Relative Importance of Solar Home System**

Rural people are having following good impacts of installing a SHS at a house or a retail shop:

1. As sunlight and heat is renewable, and provided by nature, its supply is free while it imposes no environmental burden. Indeed, the more it is used for electricity generation, the more the dependence on fossil fuel falls with consequent lowering of emission of carbon dioxide and the consequences in terms of climate change. So SHS can substitute fossil fuels for generation of electricity. According to IDCOL 2,50,000 ton fossil fuels per year can be saved.
2. Better lighting through SHS provides more time to do household chores like cooking, sewing etc. and productive works like rearing poultry farm, cattle, tailoring etc. probably at a somewhat unhurried pace. So the working hour of rural people increased at night.
3. Students can study longer hours with comfortable solar lights. They also enjoy the comfort of using fans during summer. Parents get more time to sit beside the children to supervise their education. The facility may also provide more time for reading by pleasure readers.
4. Solar home systems can be used to power televisions, radios, mobile phone chargers, small fans, radios, DVD players and Laptops. So the living pattern in rural areas has changed due to introduction of these new consumer items. Villages are experiencing a kind of urbanization in the shape of civic amenities, regular education, sanitation and health care and enhanced economic activities. These things ultimately reduce migration towards cities and relieve them of stagnation of infrastructures and civic amenities.

5. Through watching TV, DVD Players and Laptops people can have entertainment as well as information about what is going on in the country and in the outside world, the latest state of sports, culture and political developments. They can follow the information of health related and agricultural programs also. They become inspired to take part in many useful and social activities by informing many useful and socially desirable things happening around them. Moreover, through using the internet by Laptop people get acquainted with the world and this ensures their socialization.

6. Women can have the relief from cleaning kerosene lamps. So the workload of women has reduced and they have sufficient time to watch TV, listen to radio or DVD players and can assist children in their education. By watching news, health and nutrition related program they gain more knowledge and thus it produces modernization effect. They become more concerned about the maternal and child health. Moreover, they can do extra work after household job and add to family earnings such as rearing poultry and cattle, making vegetable farms & taking-up weaving and sewing projects and opening small shops. Finally, the use of light during evening ensures women's safe movement from one place to another.

7. Rural people can communicate with others through the use of mobile phones mainly due to possibility of charging the phones at home. Prior to electrification the owners of mobile phones would have to charge them at specific places and perhaps for a payment causing both financial and physical stress. This saves money for charging the mobile phones while earns an income if offered for charging other people's mobiles. Moreover through using mobile phones women can communicate with outside world and get necessary information to make them feel safe and confident also.

8. According to IDCOL, 2013 the SHS industry has created jobs for 30,000 rural people by unleashing new income-generating possibilities for people in rural Bangladesh. For example, shop owners who install a SHS can have increased sales revenue because SHS lighting provides dazzling illumination of the goods and services for sale and thus attracts more customers to the shops at night. Many households and businesses generate income by charging people a small fee to charge their mobile phone with the electricity generated by their SHS. Moreover with the help of SHS rural people can earn additional income from some productive household activities like poultry farming, working at garage, tailoring etc. at night.

In addition to that, POs are also contributing to the economy by employing a huge people for selling, distributing and maintaining SHS in rural areas. Specially one of the most prominent PO named as “Grameen Shakti” employs more than 7,500 individuals, the vast majority of whom are field assistants that sell, install and provide maintenance services related to SHS and they also operates 45 Grameen Technology Centers run by women engineers that maintain, repair and assemble the electronic parts of SHS. These centers train and employ underprivileged rural women who generally lack access to other income-generating opportunities. Thus far these centers have trained more than 3,000 women (Grameen Shakti 2010).

9. Solar home systems enjoy relative advantage over kerosene because they facilitate income generation, provide better light and are more versatile. Electric lighting also provides approximately 100 times more light than a kerosene lamp without the resulting indoor air pollution, soot and noxious odors (Asaduzzaman et. al, 2009). This generates health benefits of the rural people especially the women and children more who spend more time at house. Moreover the risks of accidents from kerosene

lamps like burns, fire etc is considerably reduced. So it can contribute to lowering of emission of carbon dioxide and the positive consequences in terms of climate change.

10. According to IDCOL, an SHS household consume on the average 3.67 liters less of kerosene per month compared to non-SHS households which comes 88.06 million liters less per year. Given that a liter of kerosene has a calorific value of 38 MJ/liter and that a terra joule of calorie from kerosene releases 19.6 MT of carbon and also that carbon dioxide molecules are 44/12 times heavier compared to carbon, the total emission reduction due to the SHS at present comes to just over 240 thousand MT of carbon dioxide. However this is only the direct reduction in emission.

## **6.4 Current Practices of SHS Industry in Bangladesh**

The Rural Electrification and Renewable Energy Development Project of GOB have two main components and two main implementing agencies. These two main components are grid electrification and renewable energy development. Rural Electrification Board (REB) through its Palli Bidyut Samities (PBSs) would implement the grid component of the project. In fact, rural electrification in Bangladesh began with the creation of REB by a Presidential Ordinance in late 1970 with some initial rural electric cooperatives (Palli Bidyut Samities-PBSs). As time progressed, additional PBSs were created in less viable areas. The main function of these cooperatives is to provide electricity in rural areas. Generally an electric cooperative is formed taking three to seven thanas (Administrative Units), comprising an area covering around one to two thousand square kilometers. The inhabitants of that area are the member consumer of that electric cooperative. The system loss of the PBSs ranges from 10 percent to 26 percent. And the Net Income/Loss ranges from

loss of Tk 38 million to income of Tk 478 million. The losses are mainly due to poor consumer mix.

Most of the villages in Bangladesh are not connected to the national grid only 57,551 villages are connected. Today only around 49% of the Bangladesh population is connected to the electricity grid. Most people in the rural areas depend on kerosene lamps for light. Due to the lack of electricity supply in rural areas, the rural population depends mainly on biomass as a source of energy such as agricultural waste and wood. Problems in the Bangladesh's electric power sector include corruption in administration, high system losses, delays in completion of new plants, low plant efficiencies, erratic power supply, electricity theft, blackouts, and shortages of funds for power plant maintenance. The Government of Bangladesh is actively engaged in energy crisis management. The National Energy Policy has the explicit goal of supplying the whole country with electricity by 2020. Eliminating load shedding and increasing access extend electrification to all Bangladeshis by increasing the installed capacity to 20,000 MW by 2021 are central to *Vision 2021*, which is the Government's plan to make Bangladesh a prosperous, middle-income country 50 years after independence. But achieving 100 percent electrification will be difficult because Bangladesh is a low-lying delta crisscrossed by hundreds of rivers. This topography contributes to the 30,000Tk (\$430) cost of extending an existing grid connection by one kilometer (Barua et. al. 2001). According to Rural Electrification Board (REB) estimates, extending the grid to marginal service areas would "cost approximately US\$13 billion. So the solar electricity can illuminate a less expensive method of extending electricity to off-grid areas in Bangladesh.

The renewable energy component of the project is following two different methodologies to extend off-grid solar to rural Bangladesh: fee-for-service and



ownership. The fee-for-service model is offered by the Rural Electrification Board (REB). REB supplies the Solar Home Systems through its PBSs by a fee for service scheme charges households a fixed monthly fee to use the solar home system (SHS) installed in their roofs. Indeed, REB was only able to install 12,000 of the targeted 16,000 SHS under World Bank-financed Rural Electrification and Renewable Energy Development (RERED) Program from 2003–2009. The same institutional constraints that limited SHS deployment also undermined after sales service, causing many systems to go into poor condition.

Conversely, the ownership model, which uses microfinance to sell SHS to rural households, has been highly successful. The project aimed to finance the sale of SHS to customers by extending grants and soft loans to the Infrastructure Development Company Limited (IDCOL), a non-bank financial institution established by the Government in 1997 to finance infrastructure development and renewable energy projects. IDCOL started the SHS program in 2003 to ensure access to clean electricity for the energy starved off-grid rural areas of Bangladesh. The program supplements the Government's vision of ensuring 'Access to Electricity for All' by 2021. With the increase of number of households by 2013, potential for PV electricity production has increased further panels within the range of 10-130Wp were being financed by IDCOL. IDCOL is supported by World Bank, German Development Cooperation (GIZ), Kreditanstalt für Wiederaufbau meaning Reconstruction Credit Institute of Germany (KfW), EU, ADB, IDB and a multi-donor trust fund administered by the World Bank—Global Partnership for Output Based Aid (GPOBA). They would implement SHS programs through the participating organizations, which could be NGOs, MFIs and Private sector agencies who are known as Partner Organizations (PO). The number of partner organizations involved has expanded to current 47

organizations at present. During this time there has also been the advent of supporting companies who manufacture and supply batteries, charge controllers, lamp circuit etc. Multilateral agencies provide grants, soft loans and technical assistance needed to GOB. Then GOB provides grants, soft loans and policy support to IDCOL. IDCOL provides grants to reduce cost of SHS and capacity building; provides soft loans, training and promo support and monitors implementation. PO identifies potential customers, installs SHS, extends micro-credit and provides after sale service. Household customers and retailers maintain SHS and repay loan in monthly installments. A diagrammatic representation of the institutions involved with the sale of SHS is as follows:

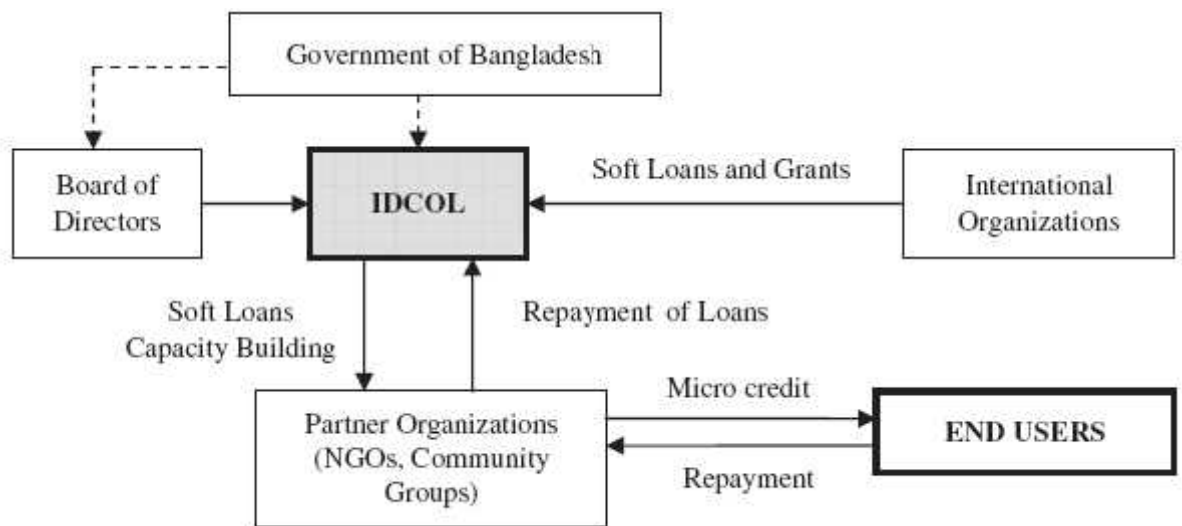


Figure 6.3: Institutions involved with the sale of SHS.

PO will be chosen depends on its institutional capacity assessment based on various indicators related to accounting and audit management, staffing, years of operation, assets position, experience of operation in off-grid area, credit operations experience, area they choose and related other criterion. Even if the POs pass these tests, although

the POs are required to go through a rigorous inspection process led by IDCOL before they qualify as POs. They are required to sell components that are approved by the “Technical Standards Committee” that includes experts from IDCOL, the Rural Electrification Board, the Local Government Engineering Department and the Bangladesh University of Engineering and Technology (IDCOL 2007). They make a contribution of their own in providing credit while they receive an institutional development grant. IDCOL gets the funds from various development partners and then disburses it to the POs based on their expansion schemes. POs are provided several incentives in the form of grants and refinancing by IDCOL for the credit given to households for buying the SHS on installments. The POs get refinancing from IDCOL only after SHSs are installed by them at the households. POs procure the system components (panels, batteries, charge controllers etc) and install the systems at the households. Sales tactics are several including distribution of handbills and brochures; use the good offices of the local elites, approaching potential customers directly etc. The households buy the systems under a micro-credit arrangement with the POs. At the time of installations, households pay a down payment of 10-15 percent of the system price and the rest is repaid over a 3 year micro-credit period. After installations, POs apply for refinancing (for part of the micro-credit part extended to households) and a capital buy-down grant to IDCOL. The following explains the financing mechanism:

- a) The capital buy-down grant (a fixed \$20 per system) is provided to help POs reduce the cost of SHS at the household level. POs also receive a grant of US\$3 for ‘Institutional Development’;
- b) In addition to the capital buy-down and institutional development grant, POs also receive refinancing of the micro-credit part from the IDCOL (80 percent of the micro-

credit extended to customers) at a flat rate of interest of 6 percent for a period of 6-8 years;

c) Against such direct incentives to POs, households receive the SHSs on credit for 3 years at a flat rate of 12 percent. POs thus receive benefits from the interest spread and the repayment period spread.

d) There is also a provision of buy back of batteries and their replacement when their life is over.

The objectives for such incentives are to encourage the POs to pass on the subsidy as much as possible onto the clients so that the rural households receive SHS at a cheaper price and that a robust and regulated market chain is established at the rural level that ensures a) quality of products, b) environmental safety requirements, c) availability of facilities for repair and maintenance and d) supply of spares, bulbs, etc. at the local level.

As part of the business of selling SHS, POs train local people for repair and maintenance and establish market chains for smooth supplies of spares, and products related to SHS maintenance. POs have also established a system through which households can buy SHS at discounted prices if they opt for shorter repayment period. Households also have the option to buy SHS for cash (in which case POs are entitled to get only the capital buy-down grants from IDCOL and not the institutional development grant). There is, within an apparently regulated marketing system, thus scope for flexibilities making effective prices vary by POs and also by the nature of demand from the clients. The majority of POs offer repayment plans: 1) a 15% down payment with an annual service charge of 6% paid on the remaining 85% over 36 monthly installments; 2) a 25% down payment with an annual service charge of 4%

on the remaining 75% of the price over 24 monthly installments; and 3) a 100% down payment with a 4% cash discount.

The SHSs are differentiated among others by their capacity to produce electricity and is calibrated in terms of Wp. POs offer various capacities of SHSs. These range from 20 Wp to 135 Wp and all types of capacities in between. The cost of SHS sold by Grameen Shakti as of July 2010 is discussed in Table 6.4:

**Table 6.4: Price of a SHS of different size offered by Grameen Shakti in 2010:**

System size	System Price
20	11,700
40	21,400
50	26,800
60	31,300
65	32,800
75	36,900
80	38,400
85	40,800

Source: Grameen Shakti, 2010.

After a household purchases a SHS, it is guaranteed free after sales service throughout the duration of the payback period. The field officers sell, install and fix minor problems as well as collect bill also, once a household finishes paying off its system and becomes its outright owner, however, the free maintenance services end. There is option of enrolling in an annual fee-for-service maintenance agreement with their PO. POs will also differ because of their staff quality and consequently the potential backstopping services provided to clients and finally on the performance of the installed SHS and thus on their impacts. Then again POs may experience differences in the demand by clients for specific packages as well as their own offers.

Government also gives incentives for companies setting up solar plants include a 15-year tax holiday and exemption from paying import duty on equipment. Foreign investors get exemptions on royalties, technical knowhow, technical assistance fees and facilities for their repatriation of profits. Foreigners working in solar energy projects need pay no income tax for the first three years of their stay in this country. In 2009, the Bangladesh Bank set up a US\$29million fund to promote solar power. Private commercial banks and state-owned banks signed an agreement with the central bank that allowed banks to draw money from this fund under a refinancing scheme with a low-interest interest rate of 5%. The banks could then lend the funds to borrowers from the solar power sector at a ceiling interest rate of 10%.

The SHS industry in Bangladesh has since its inception in 2004 undergone strong growth. World Bank-financed Rural Electrification and Renewable Energy Development Program (REREDP) reached its target of selling 50,000 SHS in August 2005 and financed a total of 320,000 SHS.

They have installed 1,073,872 SHSs by 2012 with a target to finance 1 million SHSs by the end of 2012 (Khan et al 2012, [www.idcol.org](http://www.idcol.org)). The World Bank renewed the project through the end of 2012 and set a new target of 300,000 addition SHS installations (World Bank 2009) in off grid area before the project ended in December 2009 (World Bank 2009). Total 3,863,964 SHSs have already been installed under the program in the off-grid rural areas of Bangladesh up to October 2015. IDCOL has a target to finance 6 million SHS by 2017, with an estimated generation capacity of 220 MW of electricity. More than 65,000 SHSs are now being installed every month under the program with average year to year installation growth of 58%. The program replaces 180,000 tons of kerosene having an estimated value of USD 225 million per year. Moreover, around 70,000 people are directly or indirectly involved with the

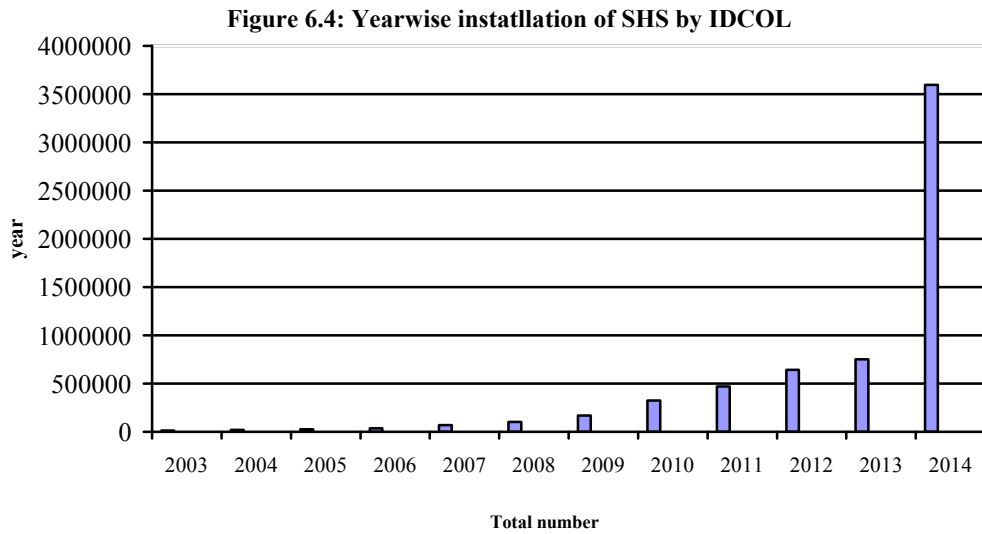
program. The program has been acclaimed as one of the largest and the fastest growing off-grid renewable energy program in the world. Year-wise installations of SHSs in Bangladesh by IDCOL is shown in table 6.5.

**Table 6.5: Year wise SHSs installation**

Year	Total installed SHS
2003	11, 697
2004	20, 635
2005	27, 579
2006	37, 151
2007	69, 562
2008	1, 03, 301
2009	1, 69, 916
2010	3, 24, 775
2011	4, 69, 572
2012	6, 43, 812
2013	7, 50, 483
2014	35, 96, 979
2015	38,63,964

Source: IDCOL, 2016

Figure 6.4 shows a sharp rise in the growth of number of yearly installation of SHS in recent years.



Among the total 47 POs, “Grameen Shakti” accounted for 58% of the SHS that have been installed. Three more POs like RSF, BRAC, and Srizony Bangladesh had installed respectively 15%, 6% and 4% of the SHS. The installation of SHS by POs are presented in Table 5.5. By divisions, the percentage distribution was Dhaka: 26, Chittagong: 19, Barisal: 19, Khulna: 11, Rajshahi: 14 and Sylhet: 11. The data is presented in table 6.6.



**Table 6.6: Partner Organization wise SHS installation up to February 2012:**

Sl. No.	Partner Organization	Number of SHSs installed
1.	Grameen Shakti	750,657
2.	Rural Services Foundation (RSF)	199,209
3.	(BRAC)	75,440
4.	Srizony Bangladesh	54,011
5.	Hilful Fazul Samaj Kallyan Sangstha (HFSKS)	32,630
6.	Upokulio Biddutayan OMohila Unnayan Samity (UBOMUS)	23,651
7.	Bangladesh Rural Integrated Development for Grub-Street Economy (BRIDGE)	19,148
8.	Integrated Development Fund (IDF)	12,618
9.	Thengamara Mahila Shabuj Shangha (TMSS)	11,787
10.	Palli Daridro Bimochon Foundation (PDBF)	9,869
11.	Solaren Foundation (SEF)	16,783
12.	Ava Development Society (AVA)	10,564
13.	DESHA	9,593
14.	Bright Green Energy Foundation (BGEF)	13,684
15.	Resource Development Foundation (RDF)	15,911
16.	Coast Trust	6,181
17.	Ingen Technology Limited	8,487
18.	Center for Mass Education In Science (CMES)	5,543
19.	Network for Universal Services and Rural Development (NUSRA)	7,651
20.	Rimso Foundation	6,798
21.	Shubashati	4,933
22.	Rural Energy and Development Initiative (REDI)	5,209
23.	Green Housing & Energy Limited (GHEL)	4,981
24.	Shakti Foundation For Disadvantages Women (SFDW)	7,417
25.	Padakhep Manabik Unnayan Kendra (PMUK)	2,046
26.	Patakuri Society	2,087
27.	Association For Development Activity of Manifold Social Work (ADAMS)	2,433
28.	Al-Falah Aam Unnayan Sangstha (AFAUS)	1,003
29.	Xenergeia	252
30.	Others	389
	Total	1,320,965

Source: IDCOL 2013

The figure 6.6 shows the approximate division wise SHSs installation. The figure illuminates that the distribution of the SHSs is highest in the Dhaka district whereas lowest in the newly formed district Rangpur.

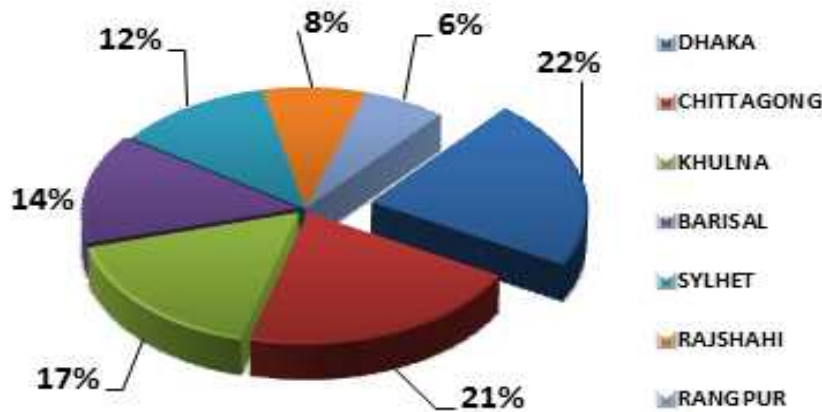


Figure 6.5 Distribution of the SHSs (Solar Home System) in seven divisions in Bangladesh

IDCOL is now giving emphasis with POs on taking care of environmental and safety compliance during storage, collection and distribution of lead acid battery, PV panel and other accessories. Under the plan, 340 MW of new capacity will be generated from systems installed on residential, commercial and industrial buildings, as well irrigation pumps, mini-grid systems and solar parks. Solar panels have already been installed in various public and private organizations including the Prime Minister’s Office and Bangladesh Bank. Steps have been taken to set up 10-15 MW solar energy based power stations at 4 different places in the country. All new buildings will also be asked to prepare for solar power installation Plans for tendering four solar power projects with generation capacity of 10 MW are under development Solar power equipment can be made locally. Government has in principal decided to install solar power units in all public and semi public offices. Installation has also taken place at the Prime Minister’s office and at Bangladesh Bank. A number of pilot projects on solar grid power are also running successfully by Government. Since November 2010, the government has mandated the installation of roof-top solar panels on all new high-

rise buildings, and it currently has other solar power projects under development with a total capacity of 35 MW.

Bangladesh power development board (BPDB) has implemented an excellent Solar PV electrification project in the Chittagong hill tracts region. The Solar PV electrification has emerged as the most appropriate technological option for the electrification of these areas. A 10 kW central AC solar PV system has been installed in one selected market in each of the three Rangamati district's sub-districts. With these systems, the shops of that market have been electrified with normal AC electricity.

In March 2011, the country set a target to install 500 megawatts of electricity via solar home systems to combat greenhouse gas emissions and to ensure sustainable development in energy. The plan is to use Asian Development Bank (ADB) solar power project funds to achieve the electricity generation target. Moreover, GOB has been working to finalize the Sustainable Energy Development Authority Act, 2011. Government has hopes that solar panel manufacturing/ assembling will soon take place in Bangladesh and government seems ready to support with climate funds, land areas etc. Seven city corporations have got solar street lights to ensure persistent light on city streets during nighttime and will eventually increase the security of city-dwellers. The government has set a target of generating 500 megawatts (MW) of green energy that is almost ten times the current amount by 2015, in an attempt to narrow the gap between current supplies of grid electricity and the needs of the country's 160 million people. The government believes investments totaling \$2.24 billion will be required to reach its solar power target. It is seeking about \$1.6 billion dollars in financing from the Asian Development Bank (ADB) and other development

partners. The plan calls for the remainder to be funded by the government and the private sector.

## **6.5 Problems Faced in the Industry**

### **High Cost of components and installation:**

Most of the rural people are unable to afford buying an SHS directly. Even paying by a monthly installment scheme is hard for them. The cost of components and installation is presents a high cost for those on minimum incomes. Therefore, the government should give enough subsidies to keep the SHS price low.

### **Risk aversion:**

Purchasing an appliance that requires a large monthly installment for three years requires a high level of confidence in the economic future of the family. Moreover, the components of a solar home system can break, and replacing these parts—especially the battery—can be very expensive.

### **Technical services are not regular enough:**

Manpower is another notable obstacle for services. There are not enough skilled technicians to support after-sales services. In fact, SHS is a totally interlocked system; if one of the devices components becomes damaged somehow, then the whole system becomes worthless. Unless the device is repaired by service center, owners are unable to get electricity from SHS. If the service issue is not improved then it may have an adverse effect on the SHS growing market.

### **Customer training:**

Customers are not getting proper training on use and handling of a SHS. So customer training should be included in the after sales service.

**Lack of awareness:**

Promotional campaigns and Training programs are needed to increase customer awareness.

**Low capacity of the system:**

The present SHS capacity may not be able to meet the full demand of the client for various energy services. Because the capacity of present models of SHS limits the use of electricity mainly to a few types of energy services, rural people are now demanding the use of more fans and refrigerator with the system.

**Disposal of Battery:**

The problem of battery disposal may become an important issue in future as this is known to have become a major source of pollution in China and India.

## **6.6 Conclusion**

The off-grid solar sector in Bangladesh has brought a superior form of lighting to millions of rural Bangladeshis, created thousands of jobs and provided rural people with new opportunities for income generation. Bangladesh did not create a new technology to build this industry; rather, it was succeeded because it was the first place to find a mechanism (microfinance) for putting the technology (Solar Home System) into the hands of the rural poor. POs operate under various imperatives and constraints. The providers of SHS service in Bangladesh should know the factors that affect demand in an area from the household and retailer survey. IDCOL should strengthen its quality control and inspections to ensure the quality issues IDCOL and POs should invest more in technician training to ensure quality installations. Technical audit by independent third parties should be more rigorous and more frequent to detect problems early and appropriate follow-up measures by IDCOL to be ensured to address the problems. The Wp choice based on price, technology and demand from buyers should coalesce together to this end. Indeed, it appears that there is demand from the POs to allow them to do business in the on-grid areas with uncertain quality of rural electrification service and provide SHS as a back-up system for those who can pay the unsubsidized cost. This demand will be more persistent if the present off-grid market is thought to be saturated or is expected to be so soon.

Given that a substantial expansion has taken place in installing SHS, that subsidy is being gradually reduced. The capacity of an off-grid SHS should be increased to supply more electricity without significantly increasing the price. Moreover, In the long run, the cost of a SHS should decrease once all components of the SHS are manufactured domestically. Successful deployment of SHS is dependent among

others on the policies of the government regarding energy prices, and financing and refinancing policies for renewable energy in general and SHS in particular. These issues need to be analyzed critically. As other countries look to extend energy services to rural areas, they should look to the Bangladesh model as one that succeeded through its leveraging of local advantages, clear policies and patience.

# **CHAPTER SEVEN**

## **FINDINGS OF THE STUDY**



## **7.1 Introduction**

This chapter examines and analyzes the customer satisfaction of SHS service among the users of SHS who are the rural people of Bangladesh. It reports the result of the analyzed data using the techniques justified in chapter four. This chapter delineates the nature and magnitude of the satisfaction problems of the users. The review and assessment is based on the analytical framework.

The goals of this chapter are to:

- Examine the data entry and missing data,
- Describe the sample demographics and usage pattern,
- Report and assess the normality of data,
- Examine the reliability and validity of constructs,
- Analysis and result of factor analysis to identify the service quality dimensions of SHS service in Bangladesh and
- Analysis and result of Hypothesis test

## **7.2 Examination of Data Entry and Missing Data**

The data analysis proceeded with examination of data entry and missing data. This is significantly to gain some critical insights into the data characteristics and analysis (Hair et al., 1998). In order to gain a high level of precision in the data entry process, a double check was performed. At first check, all entries were verified case by case and as second check, descriptive statics including frequency distribution, mean and standard deviation were conducted and verified.

In examining the completeness of returned questionnaire, it was found that 36 questionnaires contained missing data. Among those cases 15 questionnaires had 80% or more of the overall questionnaires unanswered. These cases were omitted from the preliminary analysis. It was observed that 21 questionnaires had missing response to the likert scales sections. Respondents' lack of familiarity with this type of scale could be the main reason for missing data on those sections. Therefore upon deletion of 21 cases, 314 usable samples were retained in the database (89.71 % response rate) for further examinations of normality and outliers.

## **7.3 Sample Description**

The sample in this study varied widely on personal characteristics. The profile of respondent is explored in this section as part of the assessment of the data. In terms of sample demographics, respondent characteristics are varied widely and are reported in this section. Respondents' gender, age, income, educational qualification, occupation, marital status and religion are relevant personal data. While demographic information has no impact on the level of analysis of this study, the reporting may provide a generalized view in terms of male and female participation in buying SHS, average

monthly income needed for availing a SHS in Bangladesh. The age group, gender, education status, occupational pattern, and monthly income of the sample respondents have been presented in table 7.1. The table shows that the sample was made up of mostly male respondents (91.1%). It is revealed that respondents are varied widely in terms of their age. The highest representatives of the respondents (30.9%) are from the age group of 31 to 40 years. The study observed that SHS has attracted the young people. It also shows Majority of the respondents were married (92.4%) and the rest were unmarried (7.6%). The majority (32.5%) of the users in this sample have primary education. In terms of occupation business was found to be the main source of income of the majority respondents (39.8%). The average family size of the respondents was found to be 4.82 persons who appear to be close to the country average of 4.5 persons (Bangladesh Bureau of Statistics, 2012). 26.8% of the respondents had monthly income less than or equal to TK 10,000.

**Table 7.1 Demographic data of Respondents (N=314)**

<b>Demographic Variables</b>	<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Gender	Male	286	91.1
	Female	28	8.9
Total		314	100.0
Age	20-30 years	84	26.8
	31-40 years	97	30.9
	41-50 years	63	20.1
	51-60 years	45	14.3
	60 years+	25	8.0
Total		314	100.0
Income	Less than or equal to 10,000 TK	84	26.8
	10,001-15,000 TK	61	19.4
	15,001-20,000 TK	45	14.3
	20,001-25,000TK	39	12.4
	25,001-30,000 TK	44	14.0
	30,001-35,000 TK	13	4.1
	35,001-40,000 TK	20	6.4
	40,001-45,000TK	2	.6
	45,001-50,000 TK	0	0
	50,000 TK +	6	1.9
Total		314	100.0
Educational Qualification	Below Primary	64	20.4
	Primary	102	32.5
	Secondary	72	22.9
	SSC	26	8.3
	HSC	16	5.1
	Bachelor	13	4.1
	Masters	9	2.9
	Illiterate	12	3.8
Total		314	100.0
Occupation	Self employed in farm sector	79	25.2
	Employed in farm sector	10	3.2
	Service	43	13.7
	Business	125	39.8
	Retired	10	3.2
	Driver	11	3.5
	Remittance earner	22	7
	Contractor	1	0.3
	Day laborer	5	1.6
	Housewife	7	2.2
	Student	1	0.3
Total		314	100.0

Demographic Variables	Categories	Frequency	Percentage
Marital Status	Married	290	92.4
	Unmarried	24	7.6
	Separated	0	0
	Widowed	0	0
Total		314	100.0
Religion	Muslim	222	70.7
	Hindu	91	29
	Christian		
	Buddhist	1	0.3
Family size		4.82	
Total		314	100.0

Source: Field survey, 2016

The usage pattern of SHS has been shown in the table 7.2 Majority of the respondents (28.3%) have been using the SHS for 2 years to 3 years followed by 1 year to 2 years (18.8%). The POs are offering various capacities of SHSs ranging from 20 to 135 Watt-peak (Wp) to their clients for installation. Of those supplied by them, the 20 Wp appeared to be most dominant (36.3%) followed by 50 Wp (19%), 85 Wp (19%) and 65 Wp (13%). It appears that the 20 Wp category is gaining popularity as it can serve the energy needs of the low income earning rural people. Majority of them are found taking service from Grameen shakti (49%) followed by Rural services Foundations (RSF), Rural Development Foundation (19%) and other POs. Though POs are offering the SHSs on both cash and credit most of the respondents (90%) have purchased SHS on credit for 3 years at a flat interest rate. respondents found to pay BDT 26,961 for the total price of the SHS and BDT 3,910 as down payment and BDT 701 as monthly installment. Number of lighting points varies by capacity and mostly the use is for 2-4 lighting points. Majority of them use 3 lights (31%) followed by 4 lights (29%) and 2 lights (19%). 38% of the respondents use only 1 fan and 6% use 2 fans. Respondents use some appliances like mobile phone chargers (100%), Black and

White TV (26%), color TV (5%), DVD player (4%) and Laptop (3%). Most of the respondents (33%) are found to use all the appliances for four to five hours per day followed by 3 to 4 hours (28%), 5 to 6 hours (15%) and 2 to 3 hours (13%). 12% respondent are found with battery replaced by PO whereas battery of the system is not damaged with 85% respondents. 3% of them don't know how to handle the damaged battery. Children are found as the main beneficiary in 67% of SHS households followed by women (15%), men (13%) and aged family members (8%). Detail data of the usage pattern is shown in Appendix I (from table 1 to table 10).

**Table 7.2 Usage pattern of SHS**

<b>Usage pattern</b>	<b>Categories</b>	<b>Frequency</b>	<b>%</b>
Duration of using the SHS	Less than 6 months	28	8.9
	6 months-1 year	23	7.3
	1 year-2 years	59	18.8
	2 years-3 years	89	28.3
	3 year-4 years	53	16.9
	4 years-5 years	31	9.9
	5 years -6 years	17	5.4
	6 years-7 years	2	.6
	7 years-8 years	2	.6
	8 years-9 years	7	2.2
	More than 10 years	3	1.0
Use of SHS with different Capacity	20 watt	114	36.3
	30 watt	15	4.8
	40 watt	20	6.4
	50 watt	60	19.1
	65 watt	40	12.7
	75 watt	4	1.3
	85 watt	58	18.5
	135 watt	3	.9
Duration of using SHS	2 to 3 hours	39	12.4
	3 to 4 hours	88	28
	4 to 5 hours	102	32.5
	5 to 6 hours	47	15
	6to 7 hours	16	5
	7 to 8 hours	17	5.5
	More than 8 hours	5	1.6
Most benefited member of the service	Children	209	66.6
	Men	42	13.4
	Women	51	16.2
	Aged family member	12	3.8
Handing of Damaged Battery	Returned to PO	4	1.3
	Not damaged yet	265	84.4
	Replaced by the PO	37	11.8
	No idea to do	8	2.5

Source: Field survey, 2016

## 7.4 Assessment of Normality

Normality in the data is often a conventional assumption process in the estimation process. Data distribution with either a highly skewed nature or with high kurtosis indicates non-normality due to the presence of outlier cases in the data set. In order to check any actual deviation from normality, a number of methods can be used. One method is to use skewness and kurtosis. By using this method, values for Skewness and kurtosis should not be significant if the observed distribution is exactly normal. For large sample sizes, 200 and over (Hair et al., 2003), even small deviations from normality can be significant but not substantive. Skewness is the measure of the symmetry of distribution. The normal distribution is symmetric and has a value of zero for skewness. According to Balmer (1979), the rule of thumb is:

- if skewness is less than -1 or greater than +1, the distribution is highly skewed;
- if skewness is between -1 and -.05 or between +.05 and +1 the distribution is moderately skewed and
- if skewness is between -.05 or and +.05, the distribution is approximately symmetric.

The height and sharpness of the peak relative to the rest of the data are measured by a number called kurtosis. Higher values indicate a higher, sharper peak; lower values indicate a lower, less distinct peak. A normal distribution has kurtosis exactly 3. Any distribution with kurtosis=3 is called Mesokurtic or Normal. Any distribution with kurtosis is <3 it is known as Platykurtic. A distribution with kurtosis value is >3 it is known as Lepokurtic. Compared to a normal distribution, its central peak is higher and sharper, and its tails are longer and fatter.



In this study descriptive statistics analysis using the mean scores of components of dependent and independent variables and skewness and kurtosis was conducted and the result found is shown in table 7.3.

**Table 7.3 Descriptive Statistics:**

Variables	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Reliability	3	5	4.22	.490	.024	-.886
Responsiveness	2	5	3.88	.682	-.529	-.064
Assurance	3	5	4.13	.581	-.054	-.836
Empathy	2	5	4.03	.630	-.492	.227
Tangibility	2	5	3.98	.609	-.200	-.615
Technology	3	5	4.21	.553	-.558	.041
Image of PO	2	5	4.08	.840	-.602	-.560
Perceived Value	3	5	4.07	.569	-.275	-.806
Customer Satisfaction	2	5	4.02	.732	-.567	-.133
Valid N=314						

The table shows that the mean values for each variable are between 3.88 and 4.22 indicating the level of reliability, responsiveness, assurance empathy, tangibility, technology, perceive value and customer satisfaction ranging from high (4) to highest level (5). All the standard deviation values are close. As the skewness found in the table is between -.05 and +.05, so the distribution is moderately skewed. The above results confirm that Platykurtic normality is evidenced.

## 7.5 Reliability and Validity of Constructs

To analyze data as a supportive stream, there are some interrelated statistical techniques usually used. The reliability test examine the internal consistency of the item in a measure to determine whether each observed variable should be retained or any exclusions should be done. The validity and reliability analyses were first conducted based on the procedures established by Hair et al., (2003), and Nunally and Berstein (1994). From the reliability test result it has been found that the number of valid data is 314, while the missing data is zero. Here means that all the data is processed. Table 7.3 shows that the survey questionnaires have 54 items which are related to five variables: reliability (6), responsiveness (5 items), assurance (6 items), empathy (7items), tangibility (4 items), technology (8 items), image of PO (3 items), perceived value (10 items) and customer satisfaction (5 items).

Therefore, this section explores the reliability scores for the construct measures firstly measured by using Chronbach's (1951) coefficient alpha and then using factor analysis. A principal component factor analysis using varimax was used to determine the possible dimensions of the constructs. The results of factor analysis showed that that all items for each variable had factor loading values 0.40 and above, indicating that the items met the acceptable standard of validity analysis. Further, The Kaiser-Meyer-Olkin Test (KMO) which is a measure of sampling adequacy was conducted for each variable and the results indicated that it was acceptable. Table 7.3 shows the results of validity and reliability analyses where the following results are found:

(1) Kaiser-Meyer-Olkin (KMO) and Bartlett's Test measures strength of the relationship among variables. The KMO measures the sampling adequacy which should be greater than 0.5. In the analysis, all research variables exceeded the

minimum standard of Kaiser-Meyer-Olkin's value. In the study, the Bartlett's test of sphericity is found significant that is, its associated probability is less than 0.05. In fact, it is actually 0.000, i.e. the significance level is small enough to reject the null hypothesis.

(2) Eigenvalue is the standardized variance associate with a particular factor. From the analysis it has been found that all research variables had eigenvalues larger than 1.

(3) All factors included high factor loading (.45-.95) and were statistically significant ( $p < 0.001$ ). The items for each variable exceeded factor loadings of 0.40 (Hair et al., 1998), and

(4) Reliability coefficient assesses the consistency of the entire scale with Cronbach's Alpha. In the analysis it has been found that, all variables exceeded the acceptable standard of reliability analysis of 0.70 (Nunally & Bernstein, 1994).

These statistical results showed that the measurement scales used in this study met the acceptable standard of validity and reliability analyses as shown in Table 7.4.

**Table 7.4 Results of Validity and Reliability Analyses**

Measures	Items	Factor Loading	KMO	Bartlett's Test of Sphericity	Eigenvalue	Variance explained	Cronbach Alpha
Reliability	6	.57-.80	.827	548.53	3.056	50.926	.804
Responsiveness	5	.63-.89	.836	738.18	3.212	64.248	.855
Assurance	6	.61-.86	.769	691.53	3.234	53.897	.818
Empathy	7	.45-.85	.831	1189.81	4.081	58.301	.870
Tangibility	4	.54-.85	.739	337.57	2.333	58.313	.747
Technology	8	.48-.82	.832	1162.54	4.016	65.527	.847
Image of PO	3	.86-.95	.707	673.12	2.507	83.567	.901
Perceived Value	10	.60-.79	.843	1594.18	4.778	60.204	.871
Customer Satisfaction	5	.81-.92	.869	1207.19	3.810	76.208	.921

The Pearson correlation coefficients between the independent variables (reliability, responsiveness, assurance, empathy, tangibility, technology and Image of PO) and mediating variable (perceive value) and between dependent variable (customer satisfaction) were less than 0.90, indicating the data are not affected by serious colinearity problem. These correlations also provide further evidence of validity and reliability for measurement scales used in this research (Hair et al., 1998). The detail result of the analysis is shown in Appendix I (Table 10-18).

A Correlation analysis was also done to measure the correlation among the constructs. Table 7.5 shows the inter-item correlations and it has been revealed that all the items in respective measures are positively correlated.

**Table: 7.5 Correlation between constructs**

Variables	Reliability	Responsiveness	Assurance	Empathy	Tangibility	Technology	Image	Perceived value	Customer Satisfaction
Reliability	1								
Responsiveness	.643**	1							
Assurance	.625**	.625**	1						
Empathy	.641**	.698**	.699**	1					
Tangibility	.575**	.514**	.620**	.608**	1				
Technology	.670**	.660**	.651**	.711**	.577**	1			
Image	.487**	.450**	.441**	.526**	.473**	.425**	1		
Perceived value	.665**	.554**	.629**	.606**	.613**	.721**	.524**	1	
Customer Satisfaction	.434**	.439**	.391**	.405**	.286**	.460**	.458**	.511**	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

From the table it has been found that all the variables are positively correlated. Based on Significant value obtained by the Sig. (2-tailed) of  $0.000 < 0.01$ , it can be concluded that the correlation is significant. So a linear relationship exists between these variables. In this way, the convergent validity is confirmed. The detail result of the analysis is shown in table 9 of Appendix I.

## 7.6 Result of Factor Analysis

In the current study Factor analysis is used to identify important underlying quality dimensions in Solar Home System Service of Bangladesh.

As the Kaiser-Meyer-Olkin (KMO) for this data set is found as .926, which is large, so the KMO supports factor analysis. This tests the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is matrix in which all of the diagonal elements are 1 and all off diagonal elements are 0. In our study, we can see that the Bartlett's test of sphericity is significant that is, its associated probability is less than 0.05 and in fact, it is actually 0.000. This means that correlation matrix is not an identity matrix. Thus from the perspective of Bartlett's test, factor analysis is feasible (Table 7.6).

**Table 7.6: KMO and Bartlett's Test:**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.926
Bartlett's Test of Sphericity	Approx. Chi-Square	7656.931
	Df	741
	Sig.	.000

The scree plot is a graph of the eigenvalues against all the factors. The Scree Plot is a graphic aid proposed by Cattell. It is intended to help in determining how many factors to retain where the curve starts to flatten. It can be seen that the curve begins to flatten between factors 7 and 8 (Figure 7.1). So 7 and 8 factors may be retained.

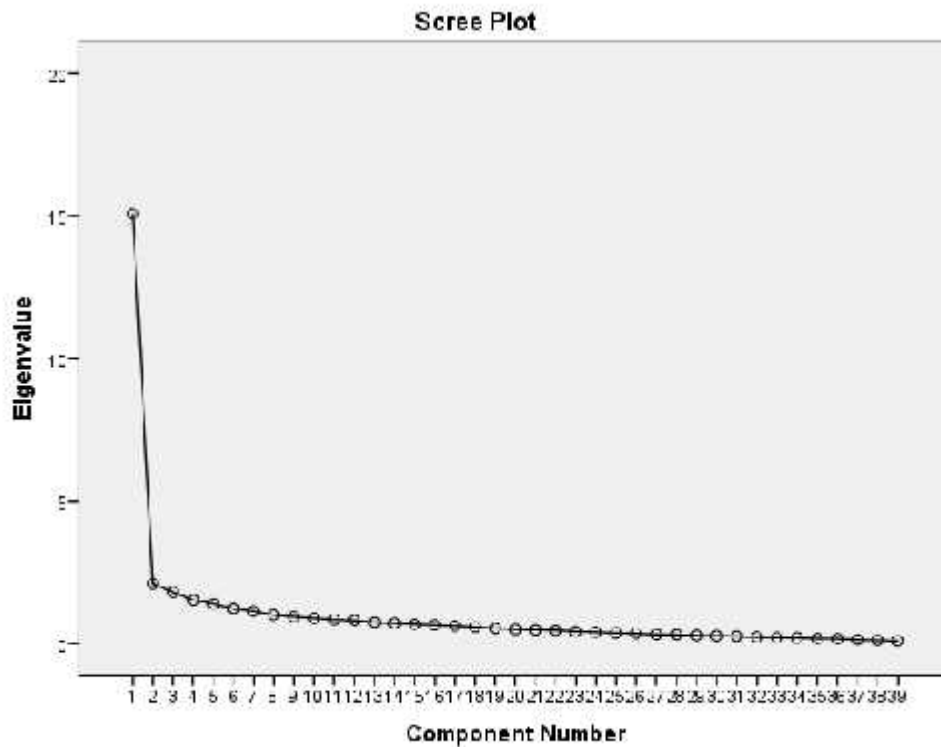


Figure 7.1: Scree Plot

To be sure about the number of factors retained the researcher also followed the total variance explained. The table 7.7 shows all the factors extractable from the analysis along with their eigenvalues, the percent of variance attributable to each factor, and the cumulative variance of the factor and the previous factors. To determine the number of components only the Eigen values greater than or equal to 1 is considered. For this study there were eight factors having Eigen values exceeding 1 (Table 7.7). The Eigen values for factors after rotation are 4.048, 3.806, 3.299, 3.280, 3.044, 2.754, 2.679 and 2.367. The percentage of the total variance which is used as an index to determine how well the factor solution accounts for what the variables together represent is 64.812%.

**Table 7.7: Total Variance Explained**

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.080	38.666	38.666	4.048	10.379	10.379
2	2.094	5.369	44.035	3.806	9.760	20.139
3	1.809	4.638	48.673	3.299	8.458	28.597
4	1.525	3.911	52.585	3.280	8.410	37.007
5	1.400	3.589	56.174	3.044	7.806	44.812
6	1.227	3.146	59.320	2.754	7.062	51.874
7	1.135	2.909	62.229	2.679	6.869	58.744
8	1.007	2.583	64.812	2.367	6.069	64.812
9	.939	2.408	67.220			
10	.890	2.281	69.501			
11	.841	2.157	71.658			
12	.819	2.099	73.758			
13	.744	1.908	75.665			
14	.711	1.823	77.488			
15	.673	1.725	79.213			
16	.649	1.665	80.878			
17	.617	1.581	82.459			
18	.579	1.485	83.944			
19	.533	1.367	85.311			
20	.494	1.268	86.579			
21	.478	1.225	87.804			
22	.462	1.184	88.989			
23	.421	1.079	90.068			
24	.400	1.026	91.094			
25	.370	.949	92.043			
26	.352	.902	92.945			
27	.317	.814	93.759			
28	.312	.801	94.560			
29	.283	.727	95.286			
30	.269	.690	95.977			
31	.257	.660	96.636			
32	.223	.572	97.208			
33	.208	.534	97.741			
34	.198	.507	98.248			
35	.175	.448	98.697			



Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
36	.166	.427	99.124			
37	.134	.344	99.468			
38	.116	.298	99.766			
39	.091	.234	100.000			

The factor matrix below contains the coefficients used to express the standardized variables in terms of factors. These coefficients, factor loadings, represent the correlation between the factors and variables. A coefficient with a large absolute value indicates that the factor and variables are closely related. Or other way, the higher the absolute value of the loading, the more the factor contributes to the variable. The gap on the table represent loadings that are less than 0.45, this makes reading the table easier. The researcher suppressed all loadings less than 0.45. The idea of rotation is to reduce the number factors on which the variables under investigation have high loadings. Rotation does not actually change anything but makes the interpretation of the analysis easier. Therefore, through rotation, the factor matrix is transformed into a simpler one that is easier to interpret (Johnson and Wichern, 2007). The most commonly used method for rotation is the Varimax procedure. Here the Varimax with Kaiser Normalization has been used as rotation method. The following rotated matrix in table 7.8 has been used to identify variables involved in each of the eight derived factors.

**Table 7.8: Rotated Component Matrix**

	Component							
	1	2	3	4	5	6	7	8
The staffs provide service as promised							.466	
They are dependable in handing your service performed							.478	
They perform the services right the first time and every time							.535	
They provide services at the promised time	.493						.445	
They are competent and make low mistakes							.607	
Staffs are honest							.734	
They Keep customers informed about when services will be performed	.636							
They give customers prompt service to you and try to keep waiting time in a minimum	.686							
They are always willing to help customers	.753							
They respond to customers' requests	.733							
They offer personalized service according to customers' needs	.460			.515				
customers feel confident using the SHS		.715						
customers feel safe in their transaction		.783						
They keep customers' dealings confidential		.498						
Staffs are consistently courteous, polite and respectful		.509						
Staffs are knowledgeable to answer customers' questions		.624						
Staffs inform new and up to date information to customers				.534				
Staffs give individual attention to customers			.519	.537				

	Component							
	1	2	3	4	5	6	7	8
Staffs deal with customers in a caring fashion			.491	.505				
Staffs are approachable and easy to contact			.591					
Staffs have interest in solving any problem regarding the service			.627					
Staffs understand the specific needs of customers			.611					
The company has convenient business hour			.653					
Solar panel, battery, appliances used are modern				.448				
The SHS is visually appealing				.553				
The staffs have neat and professional appearance				.623				
Communication materials like leaflets, catalogs etc, are visually appealing.				.563				
The SHS is successful to produce electricity								.547
There is no pollution to environment								.481
The SHS can supply electricity without any interruption								.746
The SHS is safe		.470						.422
The SHS is comfortable to use								.505
Maintenance is available on a regular basis.						.752		
They provide field level staffs to monitor customers' service						.774		
They give prompt response to any complains						.682		
The PO is Reliable					.825			
The PO is Successful company					.825			
Familiar Brand name of the PO					.824			

The first factor has been with five variables like they keep customers informed about when services will be performed; they give prompt service to customers; they are always willing to help customers; they respond to customers' requests, and they provide services at the promised time and factor 1 termed as **Responsiveness**. The second factor is highly loaded by six variables named as **Assurance** shows significance relation for customers like feel confident using the SHS; customers feel safe in their transaction; customers feel confident, staffs are consistently courteous, polite and respectful; staffs are knowledgeable to answer customers' questions and the SHS is safe. The third factor is **Empathy**; it includes four variables like staffs are approachable and easy to contact; they have interest in solving any problem regarding the service; they understand the specific needs of customers; and the company has convenient business hour. The fourth factor is **Communication**, which includes eight variables like Solar panel, battery, appliances used are modern; the SHS is visually appealing; the staffs have neat and professional appearance; communication materials like leaflets, catalogs etc, are visually appealing; they offer personalized service according to customer's needs; staffs inform new and up to date information to customer; Staffs give individual attention to customers and Staffs deal with customer in a caring fashion. The fifth factor is **Company Image** and loaded by the four variables like company is successful; the brand name of the company is familiar; the PO is reliable and the Company has convenient location of service facility. The sixth factor **After Sale Service** includes maintenance is available on a regular basis; they provide field level staffs to monitor customer service and they give prompt response to any complains. The seventh factor is **Reliability** which includes they provide service as promised; they are dependable in handing service performed; staffs perform the services right the first time; make low mistakes and they are honest. The eighth

factor is **Technology** The SHS is successful to produce electricity; there is no pollution to environment; it can supply electricity without any interruption and it is comfortable to use.

So it can be concluded that, the study has observed that the service depends on eight distinct service quality attributes as Responsiveness, Assurance, Empathy, Reliability, Communication, Image of PO, After Sale Service, Reliability and Technology of the service.

## **7.7 Result of the Analysis of Hypothesized Model**

The conceptual research framework proposed in chapter three had the aim to assess the relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction of the Solar Home System service in Bangladesh. The theoretical model includes four main hypotheses, which has been tested in this section. Hypothesis (H1) reflects the influence of service quality dimensions on customer satisfaction. Hypothesis (H2) reflects the influence of service quality dimensions on perceived value. Hypothesis (H3) reflects the influence of perceived value on customer satisfaction. Hypothesis (H4) reflects the mediating effects of perceived value to service quality dimension and customer satisfaction. Here the service quality dimensions have been treated as the independent variables and the customer satisfaction as the dependent variable. Here the perceived value acts as the mediating variable between service quality dimensions and customer satisfaction. Baron and Kenny's (1986) steps for mediations has been followed to test the hypotheses for the relationships in the model. According to them, in the first step a

linear regression was conducted to analyze the influence of service quality dimensions on customer satisfaction, in the second step influence of service quality dimensions on perceived value was also done by regression analysis and in the third step multiple regression analysis was done to explore the mediating effects of perceived value to service quality dimension and customer satisfaction. The results are shown below:

### **7.7.1 Influence of Service Quality Dimensions on Customer Satisfaction**

From the correlation table it has been found that Pearson correlation among the variables were found positive at  $P=.000$  significant level.  $R^2$  is the proportion of variance in the dependent variable explained by the independent variables. The Multiple R for the relationship between the independent variables included in the analysis and the dependent variable was 0.323, which would be characterized as weak using the rule of thumb that a correlation less than or equal to 0.20 is characterized as very weak; greater than 0.20 and less than or equal to 0.40 is weak; greater than 0.40 and less than or equal to 0.60 is moderate; greater than 0.60 and less than or equal to 0.80 is strong; and greater than 0.80 is very strong. From the analysis it can be concluded that 32.3% variance in the Customer satisfaction can be explained by the service quality dimensions. The detail result of the analysis is shown in table 19 of Appendix I.

The Durbin-Watson statistic for this problem is 1.763 which falls within the acceptable range from 1.50 to 2.50. The analysis satisfies the assumption of independence of errors. From the results in the ANOVA table F value is found as 20.903 ( $p<0.001$ ). So we can conclude that, there is an overall relationship between

the dependent variable “Customer satisfaction” and “service quality Dimensions”. Since the probability of the F statistic ( $p < 0.001$ ) was less than or equal to the level of significance (0.05), the null hypothesis that the Multiple R for all independent variables is equal to 0 was rejected.

From the table 7.5 it has been found that the best predictors of scores for the dependent variable "customer satisfaction" are “Responsiveness”, “Tangibility”, “Technology” and "Image of PO" as the b coefficient for the relationship between these variables and “Customer satisfaction” are found positive. This implies a direct relationship between the dependent and independent variables.

Table: 7.9 Result of regression analysis between “Service quality dimensions” and “customer satisfaction”:

<b>Variables</b>	<b>Standardized Coefficients Beta</b>	<b>t</b>	<b>Sig.</b>	<b>Hypothesis supported or not</b>
Reliability	.105	1.447	.149	Not Supported
Responsiveness	.144	1.976	.049	Supported
Assurance	.073	.983	.326	Not supported
Empathy	-.061	-.742	.459	Not supported
Tangibility	-.141	-2.135	.034	Supported
Technology	.242	3.176	.002	Supported
Image of PO	.306	5.300	.000	Supported

Part correlations among the independents variables are found positive except “empathy” and “tangibility”. Partial correlation between dependent and independent variables is found as: highest with Image of company as .290, technology as .179, responsiveness as .112, reliability as .082 and assurance as .056. With the tolerance statistics shows that the tolerance values for all of the independent variables are more

than tolerance value of .20 (as a rule of thumb), indicating the variables are not affected by multicollinearity problem (Fox, 1991; Tabachnick & Fidell, 2001).

All the values of the VIF are also within the standard of 4.

Hence the H1 which is there is a positive relationship between service quality dimensions and customer satisfaction of SHS service in Bangladesh is supported except for three dimensions like Reliability, Assurance and Empathy.

### **7.7.2 Influence of Service Quality Dimensions on Perceived Value**

From the correlation table it has been found that Pearson correlation among the variables were found positive at  $P=0.000$  significant level. The Multiple R for the relationship between the independent variables included in the analysis and the dependent variable was 0.637, which would be characterized as strong. From the analysis it can be concluded that 63.7% variance in the Perceived Value can be explained by the service quality dimensions. The detail result of the analysis is shown in table 20 of Appendix I.

The Durbin-Watson statistic found in the analysis of 1.712 falls within the acceptable range from 1.50 to 2.50. The analysis satisfies the assumption of independence of errors. From the results in the ANOVA table F value is found as 76.618 ( $p < 0.001$ ). So we can conclude that, there is an overall relationship between the dependent variable "Perceived Value" and "service quality Dimensions". It has been found that the best predictors of scores for the dependent variable "perceived value" were "Reliability"; "Assurance", "Tangibility", "Technology" and "Image of PO" as the b coefficient for the relationship between these variables and "Perceived Value" are



found positive. This implies a direct relationship between the dependent and independent variables. The result is shown in table 7.6.

**Table: 7.10 Result of regression analysis between “Service quality dimensions” and “perceived value”**

<b>Variables</b>	<b>Standardized Coefficients Beta</b>	<b>t</b>	<b>Sig.</b>	<b>Hypothesis supported or not</b>
Reliability	.203	3.822	.000	Supported
Responsiveness	-.042	-.794	.428	Not Supported
Assurance	.136	2.507	.013	Supported
Empathy	-.064	-1.062	.289	Not supported
Tangibility	.158	3.264	.001	Supported
Technology	.407	7.277	.000	Supported
Image of PO	.170	4.029	.000	Supported

Part correlations among the independent variables are found positive except “responsiveness” and “empathy”. Partial correlation between dependent and independent variables is found as: highest with technology as .384, Image of company as .224, reliability as .213, tangibility .183 and assurance as .142. With the tolerance statistics shows that the tolerance values for all of the independent variables are more than tolerance value of .20 (as a rule of thumb), indicating the variables are not affected by multicollinearity problem. All the values of the VIF are also within the standard of 4.

Hence the H2 which is there is a positive relationship between service quality dimensions and perceived value of SHS service in Bangladesh is supported except for two dimensions like Responsiveness and Empathy.

### **7.7.3 Influence of Perceived Value on Customer Satisfaction**

From the correlation table it has been found that Pearson correlation among the variables were found positive at  $P=.000$  significant level. The Multiple R for the relationship between the independent variables included in the analysis and the dependent variable was 0.268, which would be characterized as weak. From the analysis it can be concluded that only 26.80% variance in the customer Satisfaction can be explained by the perceived value. The detail result of the analysis is shown in table 21 in Appendix I.

The Durbin-Watson statistic found as 1.672 which falls within the acceptable range from 1.50 to 2.50. The analysis satisfies the assumption of independence of errors. The F value is found as 110.632 ( $p<0.001$ ). So we can conclude that, there is an overall relationship between the dependent variable “Perceived Value” and “service quality Dimensions”.

It has been found that the “perceived value” influences “customer satisfaction” as the b coefficient for the relationship between these variables are positive. This implies a direct relationship between the dependent and independent variables. The result is shown in table 7.6.

**Table: 7.11 Result of regression analysis between “perceived value” and “customer satisfaction”**

<b>Variables</b>	<b>Standardized Coefficients Beta</b>	<b>t</b>	<b>Sig.</b>	<b>Hypothesis supported or not</b>
Perceived value	.511	10.503	.000	Supported

Partial correlation between dependent and independent variable is found as positive as .511.

Hence the H3 which is there is a positive relationship between perceived value and customer satisfaction of SHS service in Bangladesh is supported.

#### **7.7.4 Mediating Effects of Perceived Value to Service Quality Dimensions and Customer Satisfaction**

Here the mediator variable “perceived value” and independent variable “service quality dimensions” are used simultaneously to predict the dependent variable “customer satisfaction”. The Multiple R for the relationship between the independent variables and the dependent variable was 0.354, which would be characterized as weak. Detail result of the analysis is shown in table 22 of appendix I.

From the analysis it can be concluded that only 35.4% variance in the customer Satisfaction can be explained by the service quality dimensions and Perceived Value.

The Durbin-Watson statistic for this problem is 1.769 which falls within the acceptable range from 1.50 to 2.50. The analysis satisfies the assumption of independence of errors. The F value is found as 20.855 ( $p < 0.001$ ). So we can

conclude that, there is an overall relationship between the dependent variable “customer satisfaction” and independent variables of “service quality Dimensions” and Perceived Value

It has been found that the best predictors of scores for the dependent variable "customer satisfaction" were "Responsiveness"; “Tangibility”, "Image of PO" and “perceived value” as the b coefficient for the relationship between these variables and “customer satisfaction” are found positive. This implies a direct relationship between the dependent and independent variables. The result is shown in table 7.12.

**Table: 7.12 Result of Mediation Analysis between “Service quality Dimensions”, “Perceived Value” and “Customer Satisfaction”:**

Variables	Standardized Coefficients Beta	t	Sig.	Hypothesis supported or not
Reliability	.046	.640	.523	Not Supported
Responsiveness	.156	2.187	.030	Supported
Assurance	.034	.459	.647	Not supported
Empathy	-.043	-.528	.598	Not supported
Tangibility	-.186	-2.835	.005	Supported
Technology	.125	1.547	.123	Not Supported
Image of PO	.257	4.429	.000	Supported
Perceived Value	.288	3.769	.000	Supported

Part correlations among the independents variables are found positive except “tangibility” and “empathy”. Partial correlation between dependent and independent variables is found as: highest with image of PO as .246, perceived value as .211, tangibility .160, responsiveness .124, technology .088, reliability .037 and empathy .030. With the tolerance statistics shows that the tolerance values for all of the

independent variables are more than tolerance value of .20 (as a rule of thumb), indicating the variables are not affected by multicollinearity problem. All the values of the VIF are also within the standard of 4.

The relationship between service quality dimensions and customers satisfaction has been changed significantly by adding mediator perceived value. Specifically, the inclusion of perceive value in the analysis had provided four implications:

**First**, the previous insignificant relationship between reliability and customer satisfaction ( $\beta=.105, p>0.05$ ) did not changed to significant ( $\beta=.046, p>.05$ ).

**Second**, the previous significant relationship between responsiveness and customer satisfaction ( $\beta=.144, p<0.05$ ) did not change to non significant ( $\beta=.156, p<0.05$ ) and the effect size of such relationships are increased.

**Third**, the previous insignificant relationship between assurance and customer satisfaction ( $\beta=.073, p>0.05$ ) did not change to significant ( $\beta=.034, p>0.05$ ).

**Fourth**, the previous insignificant relationship between empathy and customer satisfaction ( $\beta= -.061, p>0.05$ ) did not change to significant ( $\beta= -.043, p>0.05$ ).

**Fifth**, the previous significant relationship between Tangibility and customer satisfaction ( $\beta=-.141, p<0.05$ ) did not change to non significant ( $\beta=-.186, p<0.05$ ), but the effect size of such relationships were decreased.

**Sixth**, the previous significant relationship between technology and customer satisfaction ( $\beta=.242, p<0.05$ ) changed to insignificant ( $\beta=.125, p>0.05$ ).

**Seventh**, the previous significant relationship between Image of PO and customer satisfaction ( $\beta=.306, p<0.05$ ) did not change to non significant ( $\beta=.257, p<0.05$ ), but the effect size of such relationships were decreased.

**Eighth**, the previous significant relationship between perceived value and customer satisfaction ( $\beta=.517, p<0.05$ ) did not changed to insignificant ( $\beta=.288, p<0.05$ ), but the effect size of such relationships were decreased.

In terms of explanatory power, the inclusion of perceive value in the analysis has 35.4% variance in dependent variable compared to 32.3% previously. Statistically, these results demonstrate that after the inclusion of perceive value in the analysis, the strength of relationship between service quality characteristics and customer satisfaction has increased, signaling that perceive value does act as a partial mediating variable in the relationship between service quality characteristics and customer satisfaction of SHS service in Bangladesh.

Hence the H4 which is Perceive value mediates the service quality dimensions on customer satisfaction of SHS service in Bangladesh is supported also.

This study reveals that perceive value has partially mediated the effect of service quality dimensions (reliability, responsiveness, assurance, empathy, tangibility, technology and image of PO) on customer satisfaction.

## **7.8 Conclusion**

This chapter examines and analyzes the customer satisfaction of SHS service among the users of SHS who are the rural people of Bangladesh. It reports the result of the analyzed data using the techniques justified in chapter four. This chapter delineates the nature and magnitude of the satisfaction problems of the users. The review and assessment is based on the analytical framework. The first part of data analysis of this chapter is to examine the data entry and missing data. In order to gain a high level of precision in the data entry process, a double check was performed. At first check, all entries were verified case by case and as second check, descriptive statics including frequency distribution, mean and standard deviation were conducted and verified. In examining the completeness of returned questionnaire, it was found that 36 questionnaires contained missing data. In this study descriptive statistics analysis using the mean scores of components of dependent and independent variables and skewness and kurtosis was conducted. As the skewness found in the table is between -.05 and +.05, so the distribution is moderately skewed. The above results confirm that Platykurtic normality is evidenced. In the analysis, all research variables exceeded the minimum standard of Kaiser-Meyer-Olkin's value. In the study, the Bartlett's test of sphericity is significant that is, its associated probability is less than 0.05. From the analysis it has been found that all research variables had eigenvalues larger than 1. All factors included high factor loading (.45-.95) and were statistically significant ( $p < 0.001$ ). The items for each variable exceeded factor loadings of 0.40 and it has been found that, all variables exceeded the acceptable standard of reliability analysis of 0.70. The Pearson correlation coefficients between the independent variables (i.e., reliability, responsiveness, assurance, empathy, tangibility, technology and Image of

PO) and mediating variable (i.e., perceive value) and between dependent variable (i.e., customer satisfaction) were less than 0.90. Following this demographic profile of respondents with the usage pattern of SHS has been analyzed.

In the next section Factor analysis is conducted to identify important underlying quality dimensions in Solar Home System Service of Bangladesh. The study has observed that the service depends on eight distinct service quality attributes as Responsiveness, Assurance, Empathy, Reliability, Communication, Image of PO, After Sale Service, Reliability and Technology of the service.

The hypothesized model was tested in the next section. The theoretical model proposed in Chapter three includes four main hypotheses, which has been tested in the next section. From the analysis it can be concluded that 32.3% variance in the Customer satisfaction can be explained by the service quality dimensions. H1 which is there is a positive relationship between service quality dimensions and customer satisfaction of SHS service in Bangladesh is supported except for three dimensions like Reliability, Assurance and Empathy. H2 which is there is a positive relationship between service quality dimensions and perceived value of SHS service in Bangladesh is supported except for two dimensions like Responsiveness and Empathy. H3 which is there is a positive relationship between perceived value and customer satisfaction of SHS service in Bangladesh is also supported. H4 which is Perceive value mediates the service quality dimensions on customer satisfaction of SHS service in Bangladesh is supported also. This study reveals that perceive value has partially mediated the effect of service quality dimensions (reliability, responsiveness, assurance, empathy, tangibility, technology and image of PO) on customer satisfaction. The next chapter discusses the summery of the result of the analysis of this study. Further it draws the implications for both practice and theory.



# **CHAPTER EIGHT**

## **SUMMARY**

### **AND IMPLICATIONS**

## **8.1 Introduction**

This thesis has involved in empirical investigation of the service quality dimensions and customer satisfaction of the SHS service in Bangladesh. The central research question of this thesis was: What variables determine the service quality dimensions of the Solar Home Systems service in Bangladesh? How does service quality influence customer satisfaction of the Solar Home Systems service in Bangladesh? How does service quality influence perceived value of the Solar Home Systems service in Bangladesh? How does perceived value influence customer satisfaction of the Solar Home Systems service in Bangladesh? How does service perceived value mediate service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh? The basic objective of this study was to identify dimensions of service quality for the SHS service in Bangladesh and assess how perceived value mediates service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh. To address these research questions and to achieve the research objectives, a comprehensive review of literature was conducted from the international and local (Bangladesh) literature on relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction and consolidated in chapter two. Merging the review streams a quantitative model was developed in chapter three for having better insight the service delivery and customer satisfaction of SHs service in Bangladesh. The quantitative model was tested empirically in chapter seven. The determinants of service quality dimensions of the SHS in Bangladesh were also

investigated there. The findings are summarized in this chapter in an endeavor to address the theoretical and practical implications of the study.

## **8.2 Summary of the Analysis**

“Service Quality” and “customer satisfaction” can be studied from different aspects. However, in the present study efforts will be made to find out the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh. Solar Home System (SHS) is considered as an important emerging option to supply electricity with quality light, reliable service and long term sustainability. It converts sunlight directly into electricity to power lights, fans and mobile charger that can be used to light up homes, shops, etc, and also to charge cellular phones, run televisions, DVD player and laptops. So SHS is playing a dominant role to rural people and there are opportunities to investigate the dimensions of service quality dimensions and the customer satisfaction of the service. Moreover, measuring service quality dimensions and the customer satisfaction of the Solar Home System service are important from two perspectives. First, from customer’s perspective, having good quality service can make the customer satisfied, dependent and relied on the seller. From the seller perspective, he should try to standardize service quality to provide consistency of quality and make long lasting relationship with the customers for attaining competitive advantage. So there is a clear need to conduct a research on assessing the dimensions of its service quality and the customer satisfaction of the Solar Home System service in Bangladesh and to provide guidance to the Solar Home System providers to help to make strategies and priorities for the improvement of the service quality and the customer satisfaction.

The central research question underpinning this thesis was: What variables determine the service quality dimensions of the Solar Home Systems service in Bangladesh? How does service quality influence customer satisfaction of the Solar Home Systems service in Bangladesh?

The basic objective of this study was to identify dimensions of service quality for the SHS service in Bangladesh and assess how perceived value mediates service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh. To address these research questions and to achieve the research objectives, a comprehensive review of literature was conducted from the international and local (Bangladesh) literature on relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction and consolidated in chapter two.

To narrow the research questions two models were utilized namely SERVQUAL model (Parasuraman, 1988) and Grönroos (1984). Further an extensive review of literature was conducted to specify the service quality dimensions and mediating effects of perceived value on service quality dimensions and customers satisfaction.

Merging the review streams a quantitative model was developed in chapter three for having better insight the service delivery and customer satisfaction of SHs service in Bangladesh.

The model includes four main hypotheses, which were tested. Hypothesis (H1) reflects the positive influence of service quality dimensions on customer satisfaction. Hypothesis (H2) reflects the positive influence of service quality dimensions on perceived value. Hypothesis (H3) reflects the positive influence of perceived value on customer satisfaction. Hypothesis (H4) reflects the mediating effects of perceived

value to service quality dimension and customer satisfaction. Here the service quality dimensions have been treated as the independent variables and the customer satisfaction as the dependent variable. Here the perceived value acts as the mediating variable between service quality dimensions and customer satisfaction.

To achieve the research objective, primary data were collected by surveying the end-users through a structured questionnaire. The survey yielded 314 useable responses for the analysis, (89.71 %) response rate from SHS users in rural area of Bangladesh.

The quantitative model was tested empirically in chapter seven. A Factor analysis was conducted to identify important underlying quality dimensions in Solar Home System Service of Bangladesh. It has been observed that the service depends on eight distinct service quality attributes as responsiveness, assurance, empathy, reliability, communication, image of PO, after sale service, reliability and technology of the service. The hypothesized model was tested by adopting Mediation Analysis following the steps for mediation by Baron and Kenny's (1986). From the analysis it can be concluded that 32.3% variance in the Customer satisfaction can be explained by the service quality dimensions. Four service quality dimensions (responsiveness, tangibility, technology and image of PO) are found positively related with customer satisfaction of SHS service in Bangladesh, so the H1 is supported except for three dimensions like reliability, assurance and empathy. A positive relationship between five service quality dimensions (reliability, assurance, tangibility, technology and image of PO) and perceived value of SHS service has also been found positive except for two dimensions like responsiveness and empathy, hence H2 is supported. A positive relationship between perceived value and customer satisfaction of SHS service has also been found, hence H3 is supported. Moreover, a perceived value has been found as partial mediating factor in the relationship between the service quality

dimensions and customer satisfaction of SHS service in Bangladesh. So H4 is supported also. In this way, this thesis found supports for the research questions that fulfill the research aims by providing empirical analysis on the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh.

### **8.3 Theoretical and Managerial Implications**

The findings of this thesis offer important implications for theory and management implications to improve the overall service quality and customer satisfaction of SHS service in Bangladesh.

The following sections delineate the contributions in these regards.

#### **8.3.1. Theoretical Implications**

This study offers a comprehensive examination of service quality dimensions and customer satisfaction of SHS service in Bangladesh. It delineates the factors of service quality of SHS service in the light of current practices of the SHS industry in the country. The study also tested a new theoretical model by combining theoretical approaches from literature and empirical result from data analysis. The result suggested that determining service quality dimensions of SHS service is no doubt important to enhance customer satisfaction of the service. This is the first research of Bangladesh that has explored service quality dimensions and customer satisfaction of the service. A systematic study on these topics in developing countries is also rare. In this regard, the current study contributes to help fill the gap in the literature related to

service quality dimensions and customer satisfaction of SHS in Bangladesh and in developing countries.

This study does not only enrich the local literature with service quality dimensions and customer satisfaction of SHS in Bangladesh, but also explores the mediating role of perceived value on service quality dimensions and customer satisfaction of the service in Bangladesh. It is a significant contribution as the impact of the service quality dimensions and mediating role of perceived value on service quality dimensions and customer satisfaction of SHS service in Bangladesh has not been understood from theoretical perspectives. The study reveals that perceived value has mediated the effect of service quality characteristics (reliability, responsiveness, assurance, and empathy) on customer satisfaction. This finding is consistent with studies by Eggert and Ulaga (2002) and Ismail et al. (2009). This finding has supported and broadened service quality research literature mostly published in Western countries. The results and analysis of the thesis implied that all of the identified service quality dimensions extended the direction of the use of SERVQUAL Model of Parasuraman and Service Quality model of Gronroos in a new research setting. In this regard, the academic practitioners may gain an additional insights as well as direction in the academic body of knowledge. The findings and understanding of the Bangladesh case can be an important reference for the study of similar problems in other developing countries.

This study therefore enriches the literature related to the service quality dimensions and customer satisfaction of SHS in Bangladesh. The findings this study will also be of valuable reference to other developing countries seeking to ensure quality service and higher customer satisfaction with SHS service. The findings and understanding of

the current study can be applied as a theoretical background to study similar areas in those countries.

### **8.3.2 Managerial Implications**

The current research is a pioneering one on investigating the service quality dimensions and customer satisfaction of SHS in Bangladesh. It is therefore expected to provide useful guidelines to Providers and researchers in SHS service of Bangladesh. The understanding of the service quality and the Customer Satisfaction of the Solar Home System service in Bangladesh can suggest guidelines for making the customers satisfied and retaining in future. The findings of this study can be used as a guideline by management to improve the service quality and customer satisfaction of SHS in Bangladesh. The following are the managerial applications of the study:

The study has observed that the SHS service depends on eight distinct service quality attributes as Responsiveness, Assurance, Empathy, Reliability, Communication, Image of PO, After Sale Service, Reliability and Technology of the service. So the Providers of SHS service in Bangladesh should concentrate more on these service quality attributes and try to adopt with their current practice of service. So the PO should arrange more training for the staffs to response to the requirements of customers efficiently, be empathetic to customers, assure the quality of service and be reliable. They should hire more technical persons to handle problems found with the system. The PO should concentrate on building positive image of the company. They should monitor the operation failure by the SHS and find out reasons behind that and to take precautions for the future. They should replace old batteries for giving proper



service and apply for IDCOL for granting more modern looking & Eco-friendly SHS. They should provide after sale service to customers to make them satisfied. They should inform the customers regularly about any information of the service like possible delay or unavailability of service etc. They also should supply visually appealing communication materials like leaflets, brochures, catalogs etc. In this way, the study will help the service providers to improve the design and management of consistent service quality and customer satisfaction of SHS service, which in turn, lead to long lasting relationship with the customers.

The providers of SHS service in Bangladesh should know the factors that affect demand of the service. As Reliability, Responsiveness, Tangibility, Technology and Image of PO are found positively influence the customer satisfaction of SHS service in Bangladesh, so the service providers should concentrate more on these variable to improve the service and make customers satisfied. The staffs of the PO should be reliable as well as Responsive also to make the customers more satisfied. A good SHS with sound technology and proper communication is required also. The image of the PO works as the main basis of buying SHS in rural areas. So the PO should uphold this attribute to conquer the competition in the industry.

As the study evidenced the positive relationship between perceived value and customer satisfaction of SHS service in Bangladesh so the service providers should focus on delivering high perceived value with the service. To improve the perceived value of SHS service in Bangladesh the service providers should focus more on some service quality dimensions like Reliability, Assurance, Tangibility, Technology and Image of the company. The findings of this study suggested the perceive value as a crucial aspect of service quality where perceived value about service quality may strongly induce positive subsequent individual attitudes and behaviors like

satisfaction. Thus, it may lead to maintain and support organizational strategy and goals.

Accordingly, the findings of this research can be used as valuable reference for developing an effective SHS market in Bangladesh. This will subsequently contribute to the affordable electricity generation in Bangladesh. IDCOL and POs should invest more in technician training to ensure quality installations. The price of the system, technology and demand from buyers should be combined together.

As this study is the first one that analyses the service quality dimensions and customer satisfaction of SHS service in Bangladesh, it will therefore provide useful policy insights to the policy makers as well as researchers for improving customer satisfaction of SHS service in Bangladesh. It will help the government to realize the importance and develop ways of solving SHS service problems of rural people.

## **8.4 Conclusion**

This chapter broadly presented the findings of the study. The study examined the relationship between service quality dimensions and customer satisfaction with the mediating effect of perceived value on the relationship between service quality dimensions and customer satisfaction and contributed significantly in fulfilling the gaps in the literature in this regard. In particular, the study provided useful insights to the service providers in Bangladesh for delivering quality service and has long-term relationship with users. Recommendations for future research direction are described in next chapter.

**CHAPTER NINE**  
**CONCLUSION**  
**AND RECOMMENDATIONS**

## 9.1 Introduction

This chapter focused on the thesis limitations, conclusions and the recommendations based on discussion of the research findings. The limitations of this research are also addressed in the chapter. The goals of this chapter are to:

- To state the limitations of the study,
- To conclude the total findings of the study and
- To recommend for future research.

## 9.2 Limitations

This research on the Service Quality Dimensions and Customer Satisfaction of SHS service in Bangladesh was by no means a simple task. Despite the hard effort, this research, like other studies, has limitations.

The constraints and limitations of the research can be portrayed as follows:

- The lack of available data resources constrained the selection of indicators. The data required for customer satisfaction of SHS service was not available. Moreover the study depends only on the questionnaire survey data for related analysis.
- The study followed the Single Cross-sectional design rather than longitudinal data which may not reflect the changing situation in the context of SHS service in Bangladesh.
- There is no record exists to list the total number of people using SHS under the investigated areas. Moreover, due to time and financial constraints, the

sample size is somewhat limited, which may affect the validity of findings to some extent.

- Only two districts were selected purposively due to the fact that limited resource and time constraint of the researcher to conduct the study in all over the Bangladesh and easy access for the researcher to collect data and information. Additionally, studying more than two divisions of Bangladesh, which could provide a wider representation of the prevailing SHS service in Bangladesh, was not possible due to unavailability of required data.
- Many of the respondents did not provide all the answers to the Questionnaire due to maintaining their secrecy and lack of time constraint.
- Many of the respondents provided incomplete or fictitious information also which made the data collection hindered sometimes.
- In the study perception of the users of SHS service are considered rather than the providers. This might not explore the total picture of the service in the industry. Moreover, according to Parasuarman et al. (1985) the gap between the expectation and perception of service provider and customer should be analyzed to measure the service quality.
- From the secondary data analysis, only seven factors deemed the most important in influencing satisfaction of customer of SHs. But some constructs from the social and cultural aspects could also be used to survey customer satisfaction like security, social activities of users etc.

### **9.3 Conclusion**

Availability of adequate electricity is an indicator of the standard of living of a country. But the access to electricity in Bangladesh is one of the lowest in the world and today the coverage stands around 49% of the total population (Ministry of Finance, Government of People's Republic of Bangladesh, 2010). The chances of reaching the remaining 51% of the people by conventional power may not likely to happen in near future. Moreover, around 13 million rural households still live without power (World Bank, 2015). Even those connected to the grid experience load shading during peak hours because electricity supply can't keep up with demand. In this context Solar Energy is considered as an important emerging option to supply electricity with quality light, reliable service and long term sustainability. It is inexhaustible and pollution free. The tropical climate of Bangladesh is an advantage to the utilization of solar energy resources to meet various energy needs. Solar Home System (SHS) use solar energy for generation of electricity. This SHS provides enough electricity to power lights, fans and mobile charger that can be used to light up homes, shops, etc, and also to charge cellular phones, run televisions, DVD player and laptops. Till March 2015, a total of 35,96,979 SHSs have been established by the 47 partner organizations (POs) of a Government owned financial institution: Infrastructure Development Company Limited (IDCOL) in the off-grid rural areas. IDCOL provides grants and refinance, sets technical specification for solar equipment, develops publicity materials, provides training, and monitors PO's performance. POs install the SHSs, extend credit to the end users and provide after sale services. The household consumers and retailers can buy Solar Home System

either in cash or on credit. Different POs extend credit on different terms and conditions to the consumers for purchases of the systems. At the time of installations, households pay a down payment of 10-15 percent of the system price and the rest is repaid over a 3 year micro-credit period at a flat rate of 12 percent. By using these systems rural people can improve their social condition through education, lighting shopping places, telecommunication through SHS powered mobile phones, etc. Moreover, around 70,000 people are directly or indirectly involved in the industry. It can directly reduce considerable amount of green house gases like CFC and eventually keep our environment healthy. Through this way Solar Home systems have already made significant headway in Bangladesh. But the initial high costs, lack of demonstration of the technology, awareness and adequate after sales service, etc., are seen as the barriers in the promotion of Solar home System service. The commercial success of the Solar Home System industry in Bangladesh depends on assessing the dimensions of the service quality and the customer satisfaction of the Solar Home System service which will affect the satisfaction of the end users and make long-term relationship with the service provider. But the review of literature reveals that no systematic attempt has been made in the literature to examine the dimensions of its service quality and the customer satisfaction of the Solar Home System service in Bangladesh. So this research aims at assessing the dimensions of its service quality and the customer satisfaction of the Solar Home System service in Bangladesh and to provide guidance to the Solar Home System providers to help to make strategies and priorities for the improvement of the service quality and the customer satisfaction.

The central research question underpinning this thesis was: What variables determine the service quality dimensions of the Solar Home Systems service in Bangladesh?

How does service quality influence customer satisfaction of the Solar Home Systems service in Bangladesh?

The basic objective of this study was to identify dimensions of service quality for the SHS service in Bangladesh and assess how perceived value mediates service quality dimensions and customer satisfaction of the Solar Home Systems service in Bangladesh. To address these research questions and to achieve the research objectives, a comprehensive review of literature was conducted from the international and local (Bangladesh) literature on relationship between service quality and customer satisfaction, as well as the relationship between service quality and perceived value and mediating effects of perceived value on service quality and customer satisfaction and consolidated in chapter two.

To narrow the research questions two models were utilized namely SERVQUAL model (Parasuraman, 1988) and Grönroos (1984). Further an extensive review of literature was conducted to specify the service quality dimensions and mediating effects of perceived value on service quality dimensions and customers satisfaction.

Merging the review streams a quantitative model was developed in chapter three for having better insight the service delivery and customer satisfaction of SHs service in Bangladesh.

The model includes four main hypotheses, which were tested. Hypothesis (H1) reflects the positive influence of service quality dimensions on customer satisfaction. Hypothesis (H2) reflects the positive influence of service quality dimensions on perceived value. Hypothesis (H3) reflects the positive influence of perceived value on customer satisfaction. Hypothesis (H4) reflects the mediating effects of perceived value to service quality dimension and customer satisfaction. Here the service quality dimensions have been treated as the independent variables and the customer



satisfaction as the dependent variable. Here the perceived value acts as the mediating variable between service quality dimensions and customer satisfaction.

To achieve the research objective, primary data were collected by surveying the end-users through a structured questionnaire. The survey yielded 314 useable responses for the analysis, (89.71 %) response rate from SHS users in rural area of Bangladesh.

The quantitative model was tested empirically in chapter seven. A Factor analysis was conducted to identify important underlying quality dimensions in Solar Home System Service of Bangladesh. It has been observed that the service depends on eight distinct service quality attributes as responsiveness, assurance, empathy, reliability, communication, image of PO, after Sale Service and technology of the service. The hypothesized model was tested by adopting Mediation Analysis following the steps for mediation by Baron and Kenny's (1986). From the analysis it can be concluded that 32.3% variance in the Customer satisfaction can be explained by the service quality dimensions. Four service quality dimensions (Responsiveness, Tangibility, Technology and Image of PO) are found positively related with customer satisfaction of SHS service in Bangladesh, so the H1 is supported except for three dimensions like Reliability, Assurance and Empathy. A positive relationship between five service quality dimensions (Reliability, Assurance, Tangibility, Technology and Image of PO) and perceived value of SHS service has also been found positive except for two dimensions like Responsiveness and Empathy, hence H2 is supported. A positive relationship between perceived value and customer satisfaction of SHS service has also been found, hence H3 is supported. Moreover, a perceived value has been found as partial mediating factor in the relationship between the service quality dimensions and customer satisfaction of SHS service in Bangladesh. So H4 is supported also. In this way, this thesis found supports for the research questions that fulfill the research

aims by providing empirical analysis on the service quality dimensions and the customer satisfaction of the Solar Home System service in Bangladesh.

The findings of this thesis offer important implications for theory and management implications to improve the overall service quality and customer satisfaction of SHS service in Bangladesh. The result suggested that determining service quality dimensions of SHS service is no doubt important to enhance customer satisfaction of the service. This is the first research of Bangladesh that has explored service quality dimensions and mediating role of perceived value on service quality dimensions and customer satisfaction of the service. A systematic study on these topics in developing countries is also rare. In this regard, the current study contributes to help fill a big gap in the literature related to the service quality dimensions and customer satisfaction of SHS in Bangladesh and in developing countries. This study does not only enrich the local literature with service quality dimensions and customer satisfaction of SHS in Bangladesh, but also explores the mediating role of perceived value on service quality dimensions and customer satisfaction of the service in Bangladesh. It is a significant contribution as the impact of the service quality dimensions and mediating role of perceived value on service quality dimensions and customer satisfaction of SHS service in Bangladesh has not been understood from theoretical perspectives. The findings and understanding of the Bangladesh case can be an important reference for the study of similar problems in other developing countries. The findings and understanding of the current study can be applied as a theoretical background to study similar areas in those countries. As this study is the first one that analyses the service quality dimensions and customer satisfaction of SHS service in Bangladesh, it will therefore provide useful policy insights to the policy makers as well as researchers for improving customer satisfaction of SHS service in Bangladesh. It can also be used as

a guideline by management to improve the service quality and customer satisfaction of SHS in Bangladesh. The understanding of the service quality and the Customer Satisfaction of the Solar Home System service in Bangladesh can suggest guidelines for making the customers satisfied and retaining in future. Accordingly, the findings and recommendations of this research can be used as valuable reference for developing an effective SHS market in Bangladesh. This will subsequently contribute to the affordable electricity generation in Bangladesh. In general, It will help the government to realize the importance and develop ways of solving SHS service problems of rural people.

#### **9.4 Recommendation for Future Research**

Considering the limitations of the study, some directions are recommended for future research. The recommendations are as follows:

- This research envisaged a demanding context with theoretical assertion and validates most of the findings from the developed to developing country context. As this research explores only a developing country's perspectives, any similar developing country context like India, Pakistan or any other cross country comparative study could be worthwhile to validate the findings. However, a research avenue is open for validation in different country context.
- The study of customer satisfaction of SHS service in Bangladesh could be more comprehensive when perceptions of both service providers and customers are incorporated in the study. Therefore, a future research could be directed to compare and contrast the findings of perceptions of both service

providers and customers. In addition to this, Longitudinal data might be more authentic to validate the findings.

- The sample of study was selected purposively as the data were not available on the total number of end-users of Solar Photovoltaic Systems in Bangladesh. This study considers only the users of Solar Home Systems in some areas of the Dhaka and Barisal Division. Further research can be undertaken taking into consideration in other divisions of Bangladesh. A comparative study with other districts of the country is recommended. This will provide a deeper understanding of the SHS service in the countries' context.
- The study has developed some of the construct measures and most of those are found to be reliable and valid in the present context but these are tentative unless verified in a new research context. Any similar research direction like the customer relationship management in the industry should include these measures to test further reliability and validity.
- Another recommendation might be to examine the relative differences of influence among these constructs on different types of customers like retail shop owners, entrepreneurs etc. When such studies confirm, support, and strengthen the findings of this research and offer additional strategic guidance, the service of the Solar Photovoltaic Systems in our country could be significantly improved.

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## APPENDIX I

### ANALYTICAL DATA

Table 1: Detail data on Descriptive Analysis on How long the respondents have been using the system?

<b>Duration</b>	<b>Frequency</b>	<b>Percent</b>
Less than 6 months	28	8.9
6 months to 1 year	23	7.3
1 year to 2 years	59	18.8
2 years to 3 years	89	28.3
3 years to 4 years	53	16.9
4 years to 5 years	31	9.9
5 years to 6 years	17	5.4
6 years to 7 years	2	.6
7 years to 8 years	2	.6
8 years to 9 years	7	2.2
More than 10 years	3	1.0
<b>Total</b>	<b>314</b>	<b>100.0</b>

Table 2: Capacity of the SHS used by the Respondents

<b>Capacity (in watt)</b>	<b>Frequency</b>	<b>Percent</b>
20 watt	114	36.3
30 watt	15	4.8
40 watt	20	6.4
50 watt	60	19.1
65 watt	40	12.7
75 watt	4	1.3
85 watt	58	18.5
100 watt	2	.6
135 watt	1	.3
<b>Total</b>	<b>314</b>	<b>100.0</b>



Table 3: Provider of the SHS

Name of the providers	Frequency	Percent
Grameen Shakti	141	44.9
Panna Rural Development Foundation	1	.3
SouroShakti	2	.6
Al -Arafah Solar Energy	3	1.0
BRAC	2	.6
RDF	34	10.8
PBDF	6	1.9
Saif Powertech Ltd	4	1.3
BRIDGE	11	3.5
Rural sErVICES Foundation	59	18.8
Sunrim Energy Limited	1	.3
Strizony	6	1.9
Thengamara Mahila Shabuj Shangha	3	1.0
Hiilful Fuzul Samaj Kallan Sangstha	5	1.6
Rimso Foundation	6	1.9
AVA Development Society	16	5.1
Solaren Foundations	6	1.9
Pally Bikash Kendra	8	2.5
Total	314	100.0

Table 4: Cost of the SHS:

Types of payment	N	Minimum	Maximum	Mean	Std. Deviation
Monthly cost of the SHS	314	10600	76000	26960.70	12603.959
Down payment of the SHS	314	0	21614	3909.68	2821.585
Monthly installment of the SHS	314	0	2000	701.25	372.838

Table 5: Number of Lights used by the SHS

Number of Lights	Frequency	Percent
0	1	.3
1	8	2.5
2	60	19.1
3	98	31.2
4	92	29.3
5	28	8.9
6	17	5.4
7	7	2.2
8	3	1.0
Total	314	100.0

Table 6: Number of Fans used by the respondents

Number of Fans	Frequency	Percent
0	174	55.4
1	120	38.2
2	20	6.4
Total	314	100.0

Table 7: Number of Other Appliances used by the respondents

Appliances	Having or not having	Frequency	Percent
Mobile phone charger	Having Charger	314	100
TV (Black and white)	Not having TV (B/W)	234	74.5
	Having TV (B/W)	80	25.5
TV (Color)	Not having TV (Color)	300	95.5
	Having TV (Color)	14	4.5
DVD player	Not having DVD player	303	96.5
	Having DVD player	11	3.5
Laptop	Not having Laptop	305	97.1
	Having Laptop	9	2.9

Table 8: Duration of using the SHS

Duration (in hours)	Frequency	Percent
2 to 3 hours	39	12.4
3 to 4 hours	88	28.0
4 to 5 hours	102	32.5
5 to 6 hours	47	15.0
6 to 7 hours	16	5.1
7 to 8 hours	17	5.4
More than 8 hours	5	1.6
Total	314	100.0

Table 9: Detail data of Correlation between constructs (Inter-Item Correlation Matrix)

Items	Reliability	Responsiveness	Assurance	Empathy	Tangibility	Technology	Image of the PO	Perceived value	Customer Satisfaction
Reliability	1.000	.643	.625	.641	.575	.670	.487	.665	.434
Responsiveness	.643	1.000	.625	.698	.514	.660	.450	.554	.439
Assurance	.625	.625	1.000	.699	.620	.651	.441	.629	.391
Empathy	.641	.698	.699	1.000	.608	.711	.526	.606	.405
Tangibility	.575	.514	.620	.608	1.000	.577	.473	.613	.286
Technology	.670	.660	.651	.711	.577	1.000	.425	.721	.460
Image of the PO	.487	.450	.441	.526	.473	.425	1.000	.524	.458
Perceived value	.665	.554	.629	.606	.613	.721	.524	1.000	.511
Customer Satisfaction	.434	.439	.391	.405	.286	.460	.458	.511	1.000

Table 10: Reliability and validity of “Reliability”

Reliability Statistics	
Cronbach's Alpha	N of Items
.804	6

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.827
Bartlett's Test of Sphericity	Approx. Chi-Square	548.525
	df	15
	Sig.	.000

Correlation Matrix							
		Service as promised	Dependable	Right service	Services at the prescribed time	Competent and make low mistakes	Honest
Correlation	Service as promised	1.000	.517	.428	.517	.356	.306
	Dependable	.517	1.000	.529	.602	.350	.342
	Right service	.428	.529	1.000	.510	.219	.339
	Services at the prescribed time	.517	.602	.510	1.000	.273	.381
	Competent and make low mistakes	.356	.350	.219	.273	1.000	.401
	Honest	.306	.342	.339	.381	.401	1.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.056	50.926	50.926	3.056	50.926	50.926
2	.914	15.239	66.165			
3	.665	11.083	77.248			
4	.515	8.582	85.830			
5	.474	7.900	93.730			
6	.376	6.270	100.000			

Extraction Method: Principal Component Analysis.

Table 11: Reliability and validity of “Responsiveness”

Reliability Statistics	
Cronbach's Alpha	N of Items
.855	5

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.836
Bartlett's Test of Sphericity	Approx. Chi-Square	738.179
	df	10
	Sig.	.000

Correlation Matrix						
		Customers informed	Prompt service	Always willing to help customers	Respond to customers' requests.	Personalized service
Correlation	Customers informed	1.000	.632	.577	.589	.343
	Prompt service	.632	1.000	.646	.608	.361
	Always willing to help customers	.577	.646	1.000	.754	.453
	Respond to customers' requests.	.589	.608	.754	1.000	.487
	Personalized service	.343	.361	.453	.487	1.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.212	64.248	64.248	3.212	64.248	64.248
2	.729	14.576	78.824			
3	.456	9.130	87.954			
4	.363	7.266	95.221			
5	.239	4.779	100.000			

Extraction Method: Principal Component Analysis.

Table 12: Reliability and validity of Assurance

Reliability Statistics	
Cronbach's Alpha	N of Items
.818	6

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.769	
Bartlett's Test of Sphericity	Approx. Chi-Square	691.533
	df	15
	Sig.	.000

Correlation Matrix						
	Customers feel confident	Customers feel safe	Keeps customers' dealings confidential	Consistently courteous, polite and respectful	Knowledgeable	Informs new and up to date information

Correlation	Customers feel confident	1.000	.664	.351	.398	.351	.290
	Customers feel safe	.664	1.000	.537	.466	.634	.385
	Keeps customers' dealings confidential	.351	.537	1.000	.470	.448	.458
	Consistently courteous, polite and respectful	.398	.466	.470	1.000	.517	.356
	Knowledgeable	.351	.634	.448	.517	1.000	.295
	Informs new and up to date information	.290	.385	.458	.356	.295	1.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.234	53.897	53.897	3.234	53.897	53.897
2	.820	13.663	67.560			
3	.702	11.708	79.268			
4	.533	8.878	88.146			
5	.490	8.165	96.311			
6	.221	3.689	100.000			

Extraction Method: Principal Component Analysis.

Table 13: Reliability and validity of Empathy

Reliability Statistics	
Cronbach's Alpha	N of Items
.870	7

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.831	
Bartlett's Test of Sphericity	Approx. Chi-Square	1189.806
	df	21
	Sig.	.000

Correlation Matrix								
		Individual attention to customers	Deals with customers in a caring fashion	Approachable and easy to contact	Interest in solving any problem	Understands the specific needs of customers	Convenient business hour	Convenient location of service facility
Correlation	Individual attention to customers	1.000	.729	.521	.576	.518	.502	.213
	Deals with customers in a caring fashion	.729	1.000	.599	.569	.477	.438	.242
	Approachable and easy to contact	.521	.599	1.000	.680	.650	.590	.282
	Interest in solving any problem	.576	.569	.680	1.000	.781	.533	.250
	Understands the specific needs of customers	.518	.477	.650	.781	1.000	.586	.279
	Convenient business hour	.502	.438	.590	.533	.586	1.000	.449
	Convenient location of service facility	.213	.242	.282	.250	.279	.449	1.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.081	58.301	58.301	4.081	58.301	58.301
2	.955	13.642	71.942			
3	.709	10.122	82.064			
4	.437	6.238	88.302			
5	.392	5.596	93.898			
6	.224	3.200	97.098			
7	.203	2.902	100.000			

Extraction Method: Principal Component Analysis.

Table 14: Reliability and validity of Tangibility

Reliability Statistics	
Cronbach's Alpha	N of Items
.747	4

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.739
Bartlett's Test of Sphericity	Approx. Chi-Square	337.565
	df	6
	Sig.	.000

Correlation Matrix					
		modern Solar panel, battery and appliances	The SHS is visually appealing	Neat and professional appearance	Visually appealing communications materials
Correlation	modern Solar panel, battery and appliances	1.000	.595	.511	.296
	The SHS is visually appealing	.595	1.000	.609	.266
	Neat and professional appearance	.511	.609	1.000	.306
	Visually appealing communications materials	.296	.266	.306	1.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.333	58.313	58.313	2.333	58.313	58.313
2	.816	20.389	78.701			
3	.489	12.231	90.932			
4	.363	9.068	100.000			

Extraction Method: Principal Component Analysis.

Table 15: Result of Reliability and Validity analysis of Technology

Reliability Statistics	
Cronbach's Alpha	N of Items
.847	8



Correlation Matrix									
		The SHS is successful to produce electricity	Pollution to environment	Supply electricity without any interruptions	The SHS is safe	The SHS is comfortable	Regular maintenance	Field level staffs to monitor service	Prompt response to any campaigns
Correlation	The SHS is successful to produce electricity	1.000	.556	.431	.481	.476	.475	.383	.437
	Pollution to environment	.556	1.000	.280	.541	.437	.458	.327	.330
	Supply electricity without any interruption	.431	.280	1.000	.272	.262	.225	.282	.228
	The SHS is safe	.481	.541	.272	1.000	.519	.455	.399	.364
	The SHS is comfortable	.476	.437	.262	.519	1.000	.405	.279	.301
	Regular maintenance	.475	.458	.225	.455	.405	1.000	.740	.693
	Field level staffs to monitor service	.383	.327	.282	.399	.279	.740	1.000	.793
	Prompt response to any compaligns	.437	.330	.228	.364	.301	.693	.793	1.000

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.832
Bartlett's Test of Sphericity	Approx. Chi-Square	1162.537
	df	28
	Sig.	.000

Total Variance Explained							
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.016	50.198	50.198	4.016	50.198	50.198	3.398
2	1.226	15.329	65.527	1.226	15.329	65.527	3.226
3	.840	10.504	76.031				
4	.572	7.156	83.187				
5	.489	6.116	89.303				
6	.389	4.866	94.169				
7	.284	3.554	97.723				
8	.182	2.277	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table 16: Reliability and validity of Image of PO

Reliability Statistics	
Cronbach's Alpha	N of Items
.901	3

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.707
Bartlett's Test of Sphericity	Approx. Chi-Square	673.118
	df	3
	Sig.	.000

Correlation Matrix				
		Reliable	Successful company	familiar Brand name
Correlation	Reliable	1.000	.874	.676
	Successful company	.874	1.000	.705
	familiar Brand name	.676	.705	1.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.507	83.567	83.567	2.507	83.567	83.567
2	.369	12.286	95.853			
3	.124	4.147	100.000			
Extraction Method: Principal Component Analysis.						

Table 17: Result of Reliability and Validity analysis of Perceived Value

Reliability Statistics	
Cronbach's Alpha	N of Items
.871	10

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.843
Bartlett's Test of Sphericity	Approx. Chi-Square	1594.175
	df	45
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.778	47.782	47.782	4.778	47.782	47.782	4.158
2	1.342	13.421	61.204	1.342	13.421	61.204	3.109
3	.889	8.885	70.089				
4	.727	7.273	77.362				
5	.633	6.330	83.692				
6	.482	4.822	88.514				
7	.397	3.966	92.480				
8	.360	3.603	96.083				
9	.277	2.774	98.857				
10	.114	1.143	100.000				
Extraction Method: Principal Component Analysis.							
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.							

Component Matrix <sup>a</sup>		
	Component	
	1	2
Worth of money compared to other companies	.788	
useful compared to alternative energy sources	.665	
Outstanding quality of the service		.562
Minimum effort to receive the service	.704	
Saves time	.719	
Compared to other companies, the company offers the SHS at a fair price	.716	-.610
Compared to other companies, the SHS is reasonably priced	.733	-.592
Low maintenance cost	.771	
Increase social status	.731	
Interaction with those who have the same service	.604	
Extraction Method: Principal Component Analysis.		
a. 2 components extracted.		

## Correlation Matrix

	Worth of money compared to other companies	useful compared to alternative energy sources	Outstanding quality of the service	Minimum effort to receive the service	Saves time	Compared to other companies, the company offers the SHS at a fair price	Compared to other companies, the SHS is reasonably priced	Low maintenance cost	Increase social status	Interaction with those who have the same service
Worth of money compared to other companies	1.000	.592	.352	.502	.503	.502	.502	.491	.508	.417
useful compared to alternative energy sources	.592	1.000	.255	.420	.476	.305	.291	.383	.445	.424
Outstanding quality of the service	.352	.255	1.000	.302	.308	.045	.089	.245	.317	.174
Minimum effort to receive the service	.502	.420	.302	1.000	.604	.364	.398	.518	.443	.257
Saves time	.503	.476	.308	.604	1.000	.403	.391	.405	.466	.378

Compared to other companies, the company offers the SHS at a fair price	.502	.305	.045	.364	.403	1.000	.881	.592	.370	.280
Compared to other companies, the SHS is reasonably priced	.502	.291	.089	.398	.391	.881	1.000	.634	.388	.299
Low maintenance cost	.491	.383	.245	.518	.405	.592	.634	1.000	.519	.413
Increase social status	.508	.445	.317	.443	.466	.370	.388	.519	1.000	.564
Interaction with those who have the same service	.417	.424	.174	.257	.378	.280	.299	.413	.564	1.000

Table 18: Result of Reliability and Validity analysis of Customer satisfaction

Reliability Statistics	
Cronbach's Alpha	N of Items
.921	5

Correlation Matrix						
		Overall satisfied	Intention to say positive things	Intention to recommend this PO to others	Encourage friends and relatives to take service from them	Expect to have service from them in future
Correlation	Overall satisfied	1.000	.548	.694	.627	.693
	Intention to say positive things	.548	1.000	.685	.780	.634
	Intention to recommend this PO to others	.694	.685	1.000	.809	.799
	Encourage friends and relatives to take service from them	.627	.780	.809	1.000	.737
	Expect to have service from them in future	.693	.634	.799	.737	1.000

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.869
Bartlett's Test of Sphericity	Approx. Chi-Square	1207.193
	df	10
	Sig.	.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.810	76.208	76.208	3.810	76.208	76.208
2	.502	10.045	86.252			
3	.314	6.286	92.538			
4	.214	4.274	96.812			
5	.159	3.188	100.000			

Extraction Method: Principal Component Analysis.

Table 19: Detail data analysis of Regression between Service Quality and Customer Satisfaction

Model Summary <sup>b</sup>					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.569 <sup>a</sup>	.323	.308	.609	1.763

a. Predictors: (Constant), image of PO, technology, tangibility, responsiveness, assurance, reliability, empathy

b. Dependent Variable: customer satisfaction

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	54.236	7	7.748	20.903	.000 <sup>b</sup>
	Residual	113.424	306	.371		
	Total	167.660	313			

a. Dependent Variable: customer satisfaction

b. Predictors: (Constant), image of PO, technology, tangibility, responsiveness, assurance, reliability, empathy

Coefficients <sup>a</sup>													
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.902	.319		2.831	.005	.275	1.528					
	reliability	.156	.108	.105	1.447	.149	-.056	.369	.434	.082	.068	.423	2.365
	responsiveness	.154	.078	.144	1.976	.049	.001	.308	.439	.112	.093	.418	2.391
	assurance	.091	.093	.073	.983	.326	-.092	.275	.391	.056	.046	.405	2.471
	empathy	-.071	.096	-.061	-.742	.459	-.259	.117	.405	-.042	-.035	.326	3.068
	tangibility	-.169	.079	-.141	-2.135	.034	-.325	-.013	.286	-.121	-.100	.509	1.963
	technology	.321	.101	.242	3.176	.002	.122	.519	.460	.179	.149	.380	2.632
	Image of company	.267	.050	.306	5.300	.000	.168	.366	.458	.290	.249	.663	1.508

a. Dependent Variable: customer satisfaction

Table 20: Detail data analysis of Regression between Service Quality and Perceived Value

Model Summary <sup>b</sup>					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.798 <sup>a</sup>	.637	.628	.347	1.712

a. Predictors: (Constant), image of PO, technology, tangibility, responsiveness, assurance, reliability, empathy

b. Dependent Variable: perceived value

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.474	7	9.211	76.618	.000 <sup>b</sup>
	Residual	36.786	306	.120		
	Total	101.260	313			

a. Dependent Variable: perceived value

b. Predictors: (Constant), image of PO, technology, tangibility, responsiveness, assurance, reliability, empathy

Coefficients <sup>a</sup>													
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.085	.181		.470	.639	-.272	.442					
	reliability	.235	.062	.203	3.822	.000	.114	.356	.665	.213	.132	.423	2.365
	responsiveness	-.035	.044	-.042	-.794	.428	-.123	.052	.554	-.045	-.027	.418	2.391
	assurance	.133	.053	.136	2.507	.013	.029	.237	.629	.142	.086	.405	2.471
	empathy	-.058	.054	-.064	1.062	.289	-.165	.049	.606	-.061	-.037	.326	3.068
	tangibility	.147	.045	.158	3.264	.001	.058	.236	.613	.183	.112	.509	1.963
	technology	.418	.057	.407	7.277	.000	.305	.531	.721	.384	.251	.380	2.632
	image of PO	.115	.029	.170	4.029	.000	.059	.172	.524	.224	.139	.663	1.508

a. Dependent Variable: perceived value

Table 21: Detail data of Regression between Perceived Value and Customer Satisfaction

Model Summary <sup>b</sup>					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.517 <sup>a</sup>	.268	.265	.648	1.672

a. Predictors: (Constant), perceived value  
b. Dependent Variable: customer satisfaction

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42.708	1	42.708	101.632	.000 <sup>b</sup>
	Residual	116.820	278	.420		
	Total	159.528	279			

a. Dependent Variable: customer satisfaction  
b. Predictors: (Constant), perceived value

Coefficients <sup>a</sup>											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.290	.275		4.681	.000					
	CPV	.675	.067	.517	10.081	.000	.517	.517	.517	1.000	1.000

a. Dependent Variable: customer satisfaction



Table 22: Regression between Service Quality and Perceived Value with Customer Satisfaction

Model Summary <sup>b</sup>					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.595 <sup>a</sup>	.354	.337	.596	1.769
a. Predictors: (Constant), perceived value, image of PO, responsiveness, tangibility, assurance, reliability, empathy, technology					
b. Dependent Variable: customer satisfaction					

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.595 <sup>a</sup>	.354	.337	.596	.354	20.855	8	305	.000
a. Predictors: (Constant), perceived value, image of PO, responsiveness, tangibility, assurance, reliability, empathy, technology									

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.284	8	7.411	20.855	.000 <sup>b</sup>
	Residual	108.376	305	.355		
	Total	167.660	313			
a. Dependent Variable: customer satisfaction						
b. Predictors: (Constant), perceived value, image of PO, responsiveness, tangibility, assurance, reliability, empathy, technology						

Coefficients <sup>a</sup>													
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error				Beta	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance
1	(Constant)	.870	.312		2.789	.006	.256	1.484					
	reliability	.069	.108	.046	.640	.523	-.144	.282	.434	.037	.029	.404	2.478
	responsiveness	.167	.076	.156	2.187	.030	.017	.318	.439	.124	.101	.417	2.396
	assurance	.042	.092	.034	.459	.647	-.139	.223	.391	.026	.021	.397	2.522
	empathy	-.050	.094	-.043	-.528	.598	-.234	.135	.405	-.030	-.024	.325	3.079
	tangibility	-.223	.079	-.186	-2.835	.005	-.378	-.068	.286	-.160	-.131	.492	2.032
	technology	.166	.107	.125	1.547	.123	-.045	.376	.460	.088	.071	.324	3.088

image of PO	.224	.051	.257	4.429	.000	.124	.324	.458	.246	.204	.630	1.588
perceived value	.370	.098	.288	3.769	.000	.177	.564	.511	.211	.174	.363	2.753
a. Dependent Variable: customer satisfaction												

## APPENDIX II

### Questionnaire for SHS user

This questionnaire survey is for attaining information on Service Quality Dimensions and Customer Satisfaction of Solar Home System Service in Bangladesh to be used for completing a PhD research. The findings will be used only for academic purpose. The identity of the respondents will not be disclosed in any manner.

#### Part A: General Questions

Please Tick (√) the appropriate box:

1. How many Solar Home System units have been installed at your house/ shop?

1                       2

2. How long have you been using the SHS?

<input type="checkbox"/> Less than 6 months	<input type="checkbox"/> 6 months-1 year	<input type="checkbox"/> 1 year-2 years
<input type="checkbox"/> 2 years-3 years	<input type="checkbox"/> 3 year-4 years	<input type="checkbox"/> 4 years-5 years
<input type="checkbox"/> 5 years -6 years	<input type="checkbox"/> 6 years-7 years	<input type="checkbox"/> 7 years-8 years
<input type="checkbox"/> 8 years-9 years	<input type="checkbox"/> More than 10 years	

3. Please give the technical data of your Solar Home System:

Name of the Provider:
System in watt:
Date of Installation:

4. What is the mode of purchase?

For Cash (TK):	
For Credit (TK):	Down payment (in TK):
	Interest rate (%):
	Loan duration (years):
	Service charge (%):
	Monthly installment ( in TK):

5. How many Appliances are you using with the SHS? How long do you use those per day?

Appliances	Number
Light Bulb	
Fan	
Tube (fluorescent)	
Mobile Charger	
Radio	
TV (black and White)	
TV (Color)	
DVD player	
Laptop	
Others	

7. How long do you run the SHS per day?

- 2-3 hours                       3-4 hours                       4-5 hours  
 5-6 hours                       6-7 hours                       7-8 hours                       8 hours +

8. How stable is the electricity is produced from the SHS?

- High                       Moderate                       Low

11. How many times the SHS has malfunctioned during the service life?

- Never                       1-2 times                       2-3 times  
 3-4 times                       4-5 times                       More than 5 times

12. Who are the most benefitted members by the SHS in your house/ shop?

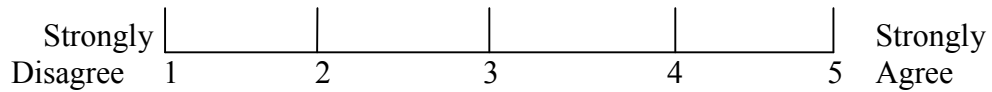
- Children                       Men                       Women  
 Aged                       Others

13. How do you handle the damaged battery (if any)?

- Return to PO                       Threw it out                       Not yet damaged  
 Do not know what to do                       Replaced by the PO

**Part B: Service Quality Dimensions**

Read the following statements and provide your opinion that is most appropriate to you by placing (√) in one of the boxes.



Statement	Strongly Disagree	Disagree	Neutral	Agreed	Strongly Agreed
1. The staffs provide service as promised	1	2	3	4	5
2. They are dependable in handing your service performed	1	2	3	4	5
3. They perform the services right the first time and every time					
4. They provide services at the promised time	1	2	3	4	5
5. They are competent and make low mistakes	1	2	3	4	5
6. Staffs are honest	1	2	3	4	5
7. They Keep you informed about when services will be performed	1	2	3	4	5
8. They give you prompt service to you and try to keep waiting time in a minimum	1	2	3	4	5
9. They are always willing to help you	1	2	3	4	5
10. They respond to your requests	1	2	3	4	5
11. They offer personalized service according to your needs	1	2	3	4	5
12. You feel confident using the SHS	1	2	3	4	5
13. You feel safe in their transaction	1	2	3	4	5
14. They keep your dealings confidential	1	2	3	4	5
15. Staffs are consistently courteous, polite and respectful	1	2	3	4	5
16. Staffs are knowledgeable to answer your questions	1	2	3	4	5
17. Staffs inform new and up to date information to you	1	2	3	4	5
18. Staffs give individual attention to customers	1	2	3	4	5
19. Staffs deal with you in a caring	1	2	3	4	5

fashion					
20. Staffs are approachable and easy to contact	1	2	3	4	5
21. Staffs have interest in solving any problem regarding the service	1	2	3	4	5
22. Staffs understand the specific needs of you	1	2	3	4	5
23. The company has convenient business hour	1	2	3	4	5
24. The company has convenient location of service facility	1	2	3	4	5
25. Solar panel, battery, appliances used are modern	1	2	3	4	5
26. The SHS is visually appealing	1	2	3	4	5
27. The staffs have neat and professional appearance	1	2	3	4	5
28. Communication materials like leaflets, catalogs etc, are visually appealing.	1	2	3	4	5
29. The SHS is successful to produce electricity	1	2	3	4	5
30. There is no pollution to environment	1	2	3	4	5
31. The SHS can supply electricity without any interruption	1	2	3	4	5
32. The SHS is safe	1	2	3	4	5
33. The SHS is comfortable to use	1	2	3	4	5
34. Maintenance is available on a regular basis.	1	2	3	4	5
35. They provide field level staffs to monitor your service	1	2	3	4	5
36. They give prompt response to any complains	1	2	3	4	5
37. The PO is reliable	1	2	3	4	5
38. It is a successful company	1	2	3	4	5
39. The Brand name of the PO is familiar	1	2	3	4	5

**Part C: Perceived Value of Service**

Read the following statements and provide your opinion that is most appropriate to you by placing (√) in one of the boxes.

Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree

Variables	Strongly Disagreed	Disagreed	Neutral	Agreed	Strongly Agreed
1. Compared to alternative energy, the SHS service is worth of money (cost savings on electric bill)	1	2	3	4	5
2. Compared to alternative energy sources, it is useful	1	2	3	4	5
3. The company helps to improve the SHS service	1	2	3	4	5
4. Quality of the service is outstanding	1	2	3	4	5
5. As they install the system at your house so it saves time	1	2	3	4	5
6. Compared to other companies, the SHS is reasonably priced	1	2	3	4	5
7. The company offers the SHS at low price	1	2	3	4	5
8. You have to pay low maintenance cost	1	2	3	4	5
9. The services increase your social status	1	2	3	4	5
10. You like to interact with those who have the same service	1	2	3	4	5

**Part D: Customer Satisfaction dimensions**

Read the following statements and provide your opinion that is most appropriate to you by placing (√) in one of the boxes.

Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree

Variables	Strongly Disagreed	Disagreed	Neutral	Agreed	Strongly Agreed
1. You are overall satisfied with the service	1	2	3	4	5
2. You intend to say positive things about the PO to other people	1	2	3	4	5
3. You intend to recommend this PO to others who seek your advice	1	2	3	4	5
4. You will encourage friends and relatives to take service from the PO	1	2	3	4	5
5. You expect to have service from the PO in future	1	2	3	4	5

**Part E: Demographic Variables**

1. Gender  Male  Female  Others
2. Age  20-30 years  31-40 years  41-50 years  
 51-60 years  60 years+
3. Religion  Muslim  Hindu  Christian  Buddhist
4. Marital Status  Single  Married  Separated  Widowed
5. Education  Bellow Primary  Primary  
 Secondary  Higher Secondary  
 Bachelor  Masters  Illiterate
6. Occupation  Self employed in farm sector  Employed in farm sector  
 Service  Business  Retired  
 Driver  Remittance earner  Contractor  
 Day laborer  Housewife  Student
7. Monthly income  <10,000 TK  10,000-15,000 TK  
 15,001-20,000 TK  20,001-25,000TK  
 25,001-30,000 TK  30,001-35,000 TK  
 35,001-40,000 TK  40,001-45,000TK  
 45,001-50,000 TK  50,000 TK +

8. Number of family member in the household: \_\_\_\_\_

9. Name of the Respondent: \_\_\_\_\_

10. Address:

Village: \_\_\_\_\_ Union: \_\_\_\_\_

Upazila: \_\_\_\_\_ District: \_\_\_\_\_

**Thank you for your kind cooperation all the way.**



### APPENDIX III

#### বাংলাদেশে সৌর বিদ্যুৎ ব্যবহারকারীদের জন্য প্রশ্নমালা

এই প্রশ্নমালা “বাংলাদেশে সৌর বিদ্যুৎ সেবার গুণাবলী এবং ক্রেতার সন্তুষ্টি” টি গবেষণার তথ্য সংগ্রহের জন্য ব্যবহার হবে। প্রাপ্ত তথ্য শুধুমাত্র একাডেমিক কাজে ব্যবহার হবে। জরিপে অংশগ্রহণকারীর ব্যক্তিগত পরিচয় সংক্রান্ত তথ্য কোন অবস্থাতেই প্রকাশ করা হবে না।

#### প্রথম পর্ব: সৌরবিদ্যুৎ সিস্টে ব্যবহার সংক্রাম

অনুগ্রহ প্রযোজ্য বাক্সে (√) চিহ্ন।

/দোকানে কয়টি সৌরবিদ্যুৎ সিস্টে স্থাপন ক ?	
<input type="checkbox"/> টি	<input type="checkbox"/> টি
সিস্টেমটি ব্যবহার : ?	
<input type="checkbox"/>	<input type="checkbox"/> - <input type="checkbox"/> -
<input type="checkbox"/>	<input type="checkbox"/> - <input type="checkbox"/> -
<input type="checkbox"/>	<input type="checkbox"/> - <input type="checkbox"/> -
- <input type="checkbox"/>	<input type="checkbox"/>

সিস্টেমটির প্র ক্রিগত তথ্য : ?

সৌরবিদ্যুৎ সিস্টেম	প্রতিষ্ঠানের নাম ?
সিস্টেমটি :	?
সিস্টেমটি স্থাপনের ক	?

8 সিস্টেমটি কেনার : ?

( ) :	
কিস্তিতে:	অগ্রিম মূল্য ( ) : কিস্তি ( ) : ( ) : সার্ভিস চার্জ ( ) : কিস্তি প্রদানে ব্যর্থ: _____

সিস্টেমটি যন্ত্রপাতি ক ?

যন্ত্রপাতির #	কয়টি
( )	
( )	
মোবাইলফোন চার্জার	
টেলিভিশন( - )	
টেলিভিশন( )	
ল্যাপটপ	

সৌরবিদ্যুৎ সিস্টেমটি দৈনিক ঘন্ট ?

- ঘন্ট- ঘন্ট       ঘন্ট- ঘন্ট       ঘন্ট- ঘন্ট  
 ঘন্ট- ঘন্ট       ঘন্ট- ঘন্ট       ঘন্ট- ঘন্ট  
 ঘন্টার বেশী

সৌরবিদ্যুৎ সিস্টেমটিতে : ক্রাী দেখা ?

- কক্ষলো       -       -  
 -      -       বেশী

সৌরবিদ্যুৎ সিস্টেমটি ব্যবহারে এ: / দোকানের স: বেশী

?

- ছেলেমেয়েদের        
 বয়স্ক লোকদের      পুরু   
 নষ্ট      ব্যাটারি ব: ?  
 নষ্ট       সৌরবিদ্যুৎ সিস্টেমসরবরাহকারী  
 ফেলে      প্রতিষ্ঠা  
       সৌরবিদ্যুৎ সিস্টেম      স:      প্রতিষ্ঠা  
 প্রতিস্থাপন কা

দ্বিতীয় পর্ব: সেবার গুণাবলী

বাক্যগুলির জন্য:      দ্বারা সর্বোচ্চ অসম্মতি      দ্বারা সর্বোচ্চ সম্মতি বোঝানো

সর্বোচ্চ অসম্মতি      |      |      |      |      |      সর্বোচ্চ সম্মতি

ক্রা	সর্বোচ্চ অসম্মতি	অসম্মতি	অসম্মতি সম্মতি কোনটি	সম্মতি	সর্বোচ্চ সম্মতি
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	প্রতিষ্ঠানটি যে সেবা প্রতিশ্রুতিবদ্ধ				
	সেবা নির্ভরযোগ্য				
	প্রথম ঠিকমতে সেবা দেয়				
	প্রতিশ্রুতি সেবা				
	কর্মচারীরা দক্ষ				
	কর্মচারীরা মৎ				
	সেবা দেয়া				
	সর্বনিম্ন রা চেষ্টা ক	সেবা দেয়	অপেক্ষার		
	সাহায্য	ইচ্ছুক			
	দেয়				
	ব্যক্তিগত প্রয়োজন	সেবার প্রদান			
	সৌরবিদ্যুৎ সিস্টেমটি ব্যবহারে ও	আসন্ন বিশ্বাস			
	লেনদেন				
	বানিজ্যিক সমস্বর্কের গোপনীয়ভাবে				
	রক্ষ				
	কর্মচারীরা	ভদ্র মার্জিত এ সশ্রদ্ধ			
	প্রশ্নের উত্তর দেয়ার	জ্ঞানম্পন্ন			
	সৌরবিদ্যুৎ সিসটে সংক্রান্ত				
	তথ্য				
	কর্মচারীরা	প্রতি স্বতঃ	দেয়		
	কর্মচারীরা	সতর্কতার	লেনদেন		
	কর্মচারী	সাম্ব্যাত			
	সেবা সংক্রান্ত যে কোন সমস্যা	কর্মচারীরা			
	উৎসাহী				
	কর্মচারীরা	সুনির্দিষ্ট প্রয়োজন			
	প্রতিষ্ঠানে ব্যবসায়িক লেনদেনের				
	অবস্থানে প্রতিষ্ঠানটির সেবা নেয়ার				
	সৌর প্যানেল, ব্যাটারি এ ব্যবহৃত যন্ত্রপাতি				
	সিস্টেমটি দেখতে আকর্ষণীয়				
	কর্মচারীদের দেখতে পরিপাটি	পেশাদারি ন			
	যোগাযোগের উ	যেমন লিফ্ট, ক্যাটালগ ইত্যাদি			
	দেখতে আকর্ষণীয়				
	সিস্টেমটি বিদ্যুৎ উৎপাদনে				
	কোন				
	এটি কোনো বিদ্যুৎ	বিদ্যুৎ সরং			
	সিস্টেমটি				
	সিস্টেমটি ব্যবহারে ও				
	স্তিতিতে রক্ষণাবেক্ষণ				
	সেবার প্রতিবেদন নেয়ার জন্য	পর্যায়ে			
	কর্মচারী				
		প্রতি স্রুৎ	দেয়		
	প্রতিষ্ঠানটি নির্ভরযোগ্য				
	প্রতিষ্ঠানটি স				
	প্রতিষ্ঠানটির ব্র্যান্ড ন				

পর্ব: উপলব্ধ সেবা

বাক্যগুলির জন্য:

দ্বারা সর্বোচ্চ অসম্মতি

দ্বারা সর্বোচ্চ সম্মতি বোঝানো

সর্বোচ্চ অসম্মতি

সর্বোচ্চ সম্মতি

ক্রঃ		সর্বোচ্চ অসম্মতি	অসম্মতি	অসম্মতি সম্মতি কোনটি	সম্মতি	সর্বোচ্চ সম্মতি
	অন্যান্য বিদ্যুৎশক্তির উৎসের চেয়ে ব্যবহারে ৩					
	অন্যান্য বিদ্যুৎশক্তির উৎসের চেয়ে উৎসটি বেশি কার্যকর					
	সিস্টেমটির উন্নয়নে সাহায্য					
	সিস্টেমটির গুণগত					
	/দোকানে এ সিস্টেমটি স্থাপন : প্রশ্ন					
।	বেঁচে য					
	অন্যান্য প্রতিষ্ঠানের চেয়ে					
	অন্যান্য প্রতিষ্ঠানের চেয়ে . নামাঙ্কিত বিক্রি					
	রক্ষণাবেক্ষণ ৩					
	সিস্টেমটি ব্যবহারে মর্যাদা বৃদ্ধি পেয়েছে					
।	প্রতিষ্ঠান থেকে সক্রিয়					

চতুর্থ পর্ব: ক্রেতা সন্তুষ্টি

বাক্যগুলির জন্য:

দ্বারা সর্বোচ্চ অসম্মতি

দ্বারা সর্বোচ্চ সম্মতি বোঝানো

সর্বোচ্চ অসম্মতি

সর্বোচ্চ সম্মতি

ক্রঃ		সর্বোচ্চ অসম্মতি	অসম্মতি	অসম্মতি সম্মতি কোনটি	সম্মতি	সর্বোচ্চ সম্মতি
	প্রতিষ্ঠানটির সেবা সার্বিকভাবে সন্তুষ্টি					
	প্রতিষ্ঠান সম্পর্কে অন্যান্য ম					
	কেউ সৌরবিদ্যুৎ সিস্টে সম্পর্কে প্রতিষ্ঠানের পরামর্শ দেবেন					
	বন্ধু আত্মীয়দের প্রতিষ্ঠান থেকে সেবা অনুপ্রাণিত :					
	ভবিষ্যতে সৌরবিদ্যুৎ সিস্টে সেবা প্রয়োজন প্রতিষ্ঠান থেকেই সেবা নেয়ার					

পঞ্চম পর্ব: ক্রেতা জনসংখ্যাতন্ত্র

